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RECOMMENDATIONS FOR THE IMPLEMENTATION OF FOUR PROJECTS

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

RECOMMENDATIONS FOR THE IMPLEMENTATION OF FOUR PROJECTS BY THE SECRETARY OF THE ARMY

VOLUME II OF VI



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LOUISIANA COASTAL AREA (LCA)
ECOSYSTEM RESTORATION STUDY

Volume II of VI

Final Integrated Feasibility Study and
Supplemental Environmental Impact Statement

for the

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana



October 2010

U.S Army Corps of Engineers
New Orleans District

Coastal Protection and
Restoration Authority

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ECOSYSTEM RESTORATION STUDY

Volume II of VI

Final Integrated Feasibility Study and
Supplemental Environmental Impact Statement

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Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

The responsible lead Federal agency for this study is the U. S. Army Corps of Engineers- Mississippi Valley, New Orleans District (CEMVN). The non-Federal sponsor for the study is Coastal Protection and Restoration Authority (CPRA). This report is a combined feasibility report and environmental impact statement complying with requirements of the U.S. Army Corps of Engineers (USACE) and the Council of Environmental Quality (CEQ), and is intended to reduce duplication and paperwork. An asterisk (*) in the table of contents notes paragraphs that are required for National Environmental Policy Act (NEPA) compliance.

October 2010

U.S Army Corps of Engineers
New Orleans District

Coastal Protection and
Restoration Authority

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This report contains six volumes.

You are at **Volume II** which is the element-specific analysis for the **The Louisiana Coastal Area-Amite River Diversion Canal Modification Element**.

Volume I:	Summary
Volume II:	**Amite River Diversion Canal Modification**
Volume III:	Atchafalaya Conveyance to N. Terrebonne Marshes
Volume IV:	Convent/Blind River Diversion
Volume V:	Terrebonne Basin Barrier Shoreline Restoration
Volume VI:	White Ditch Diversion

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Final Integrated Feasibility Study and Supplemental Environmental Impact Statement for the LCA Amite River Diversion Canal (ARDC) Modification Project

LEAD AGENCY: U.S. Army Corps of Engineers (USACE) – Mississippi Valley Division, New Orleans District

ABSTRACT: The USACE proposes to dredge openings in the existing ARDC dredged material berm, construct bifurcated conveyance channels, and establish vegetative plantings in the study area. The natural hydrology in the study area has been modified by the ARDC and a railroad grade. Sea level changes and geological subsidence have compounded these effects, leading to poor swamp health and ecosystem degradation. This project would establish hydrologic connectivity between the ARDC and the western Maurepas Swamp, allowing the swamp to drain during seasonal low-flow conditions in the Amite River and promoting the germination and survival of the seedlings of bald cypress and other trees. This connectivity would allow nutrients and sediments to be introduced into the swamp during flood events and localized rainfall events and improve biological productivity.

Without action, the swamp habitat surrounding the ARDC would continue the conversion from a freshwater swamp to freshwater marsh and open water. Direct impacts would be the continued impoundment of swamp water within the study area, decreased hydrologic connectivity, and a transition toward marsh and salinity tolerant vegetation. Indirect effects would be the decline of wildlife, fishery, and vegetative resources. Flora and fauna may change as salt-tolerant species replace fresh water species. Existing habitat would convert to waterbottoms and alter the benthic community, decreasing available nutrients and detritus. Cumulative impacts would be the projected conversion of 18,204 acres of swamp to fresh marsh and open water. The water and air treatment functions of wetlands would subside, and the integrity of existing resources within the study area would be endangered.

Excluding the No-Action Alternative, the final array of alternatives included seven options. Alternative 33 was chosen as the recommended plan. It would restore 1,602 acres of swamp habitat, create 679 Average Annual Habitat Units (AAHUs), 5.0 acres of bottomland hardwood habitat, establish hydrologic connectivity, promote the germination and survival of the seedlings of bald cypress and other trees, and improve biological productivity. According to the Micro-Computer Aided Cost Estimating System (MCACES), the total fully funded estimated cost for construction of this alternative would be $8,540,000.

COMMENTS: Please send comments or questions on this SEIS to the U.S. Army Corps of Engineers, New Orleans District, Attention: William P. Klein, Jr., P.O. Box 60267, New Orleans, Louisiana 70160-0267. Telephone: (504) 862-2540; FAX: (504) 862-2088. The official closing date for receipt of comments will be 30 days from the date on which the Notice of Availability of the Final SEIS appeared in the Federal Register.

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EXECUTIVE SUMMARY

ES.1 SUMMARY INTRODUCTION AND STUDY INFORMATION

Title VII of the Water Resources Development Act (WRDA) 2007 authorizes the Louisiana Coastal Area (LCA) program. This authorization was recommended by the Chief of Engineer's Report, dated January 31, 2005. This report recommended projects and features that reintroduce historical flows of river water, nutrients, and sediment to coastal wetlands; restore coastal hydrology to minimize saltwater intrusion; and maintain the structural integrity of the coastal ecosystem. One project feature of this recommendation was modifications to the Amite River Diversion Canal (ARDC).

This report concerns the LCA ARDC Modification project, located along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. Prior studies and reports have documented degradation in the swamp adjacent to the ARDC and have demonstrated a need for ecosystem restoration that simulates historical hydrologic conditions. This project would establish hydrologic connectivity between the ARDC and the western Maurepas Swamp, allowing the swamp to drain during seasonal low-flow conditions in the Amite River and promoting the germination and survival of the seedlings of bald cypress and other trees. This connectivity would also allow nutrients and sediments to be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events. Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat deterioration. Finally, the establishment of hydrologic connectivity would reduce the likelihood of the swamp being converted to marsh or open water.

Louisiana contains one of the largest expanses of coastal wetlands in the contiguous United States and accounts for 90 percent of the total coastal wetland loss occurring in the Nation. The Maurepas Swamp complex is the second largest continuous coastal forest in Louisiana, comprising over 190,000 acres of freshwater swamp habitat. The LCA ARDC study area is an essential ecosystem since it includes wetland habitats and provides high fish and wildlife value as well as habitat for migratory birds and other aquatic organisms including threatened or endangered species.

ES.2 NEED FOR AND OBJECTIVES OF ACTION*[1]

The natural processes of subsidence, habitat switching, and erosion of wetlands, combined with a widespread human alteration, have increased rates of wetland loss

[1] An asterisk denotes paragraphs that are required for National Environmental Policy Act (NEPA) compliance.

and ecosystem degradation. Without action, Louisiana's coastal ecosystem is not sustainable. This loss of sustainability has manifested itself as accelerated land loss. Coastal Louisiana is projected to lose an additional 328,000 acres of coastal marshes, swamps, and barrier islands by the year 2050. The following ecosystem functions are at risk:

- Vegetative habitat suitability and community diversity;
- Elevational maintenance and soil contribution from decomposing organic material;
- Protection against substrate erosion;
- Water quality improvement;
- Nutrient uptake and carbon sequestration;
- Important nursery habitat;
- North American Central Flyway and North American Mississippi Flyway waterfowl;
- wintering habitat; and
- Resting and feeding areas for neotropical migrants.

The natural hydrology within the study area has been modified by the construction of the ARDC and a railroad grade. Sea-level rise and geological subsidence have compounded the effects of these modifications. This has led to poor swamp health and ecosystem degradation including surge-related saltwater intrusion; impoundment of water; and lack of freshwater, sediment and nutrient input. Functions of the freshwater swamp lost include habitat for wildlife and aquatic species, recreational opportunities, aesthetics, and storm surge protection. Upon severe degradation; the swamp will convert to freshwater marsh, then to open water.

Investigation led to the establishment of the following planning objectives to be implemented within the study area over the 50-year period of analysis:

- Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.
- Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.
- Facilitate natural hydrologic cycle within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.
- Improve fish and wildlife habitat within the study area over the 50- year period of analysis.

The LCA ARDC Modification project is designed to be within the scope of the LCA 2004 report. The goal of the LCA Plan is to reverse the current trend of degradation

of the coastal ecosystem using restoration strategies that: reintroduce historical flows of river water, nutrients, and sediment to coastal wetlands: restore coastal hydrology to minimize saltwater intrusion; and maintain the structural integrity of the coastal ecosystem (LCA, 2004).

ES.3 ALTERNATIVES*

PLANNING CONSTRAINTS

Specific Planning Constraints identified for the LCA ARDC Modification project include the following:

Flood Control: The ARDC is a component of the AR&T (1956) flood control channel. Project plans must not significantly decrease the performance and original intent of the ARDC and the Amite River and Tributaries (AR&T) project.

Designated Scenic Rivers: Blind River, located within the study area, is a designated Scenic River. Designated Scenic Rivers are protected by a set of use restrictions including channelization, clearing and snagging, channel realignment, reservoir construction, and commercial cutting or harvesting of trees or timber in violation of the Louisiana Scenic Rivers Act.

Hydroperiod: Water levels within the ARDC exhibit seasonal high channel flow and low channel flow intervals. The natural variability of the hydroperiod necessitates a project design that allows the project to function as intended under a variety of flow regimes.

Other items that were taken into consideration during plan development and plan selections include:

Drainage Infrastructure: Formulating a project design that does not impair the capacity of the existing drainage system with additional waters would help to ensure that residential flooding is minimized in the area.

Recreation: Minimize disruption of existing recreational use of the area and ARDC vessel traffic to the extent practicable.

Existing Development: Existing residential structures and recreational facilities along portions of the ARDC dredged material berms may pose design challenges.

Water Quality: Planning objectives of the proposed project include the periodic draining of the swamp during low-flow intervals in the channel and

flushing the adjacent habitat during high-flow intervals. Swamps may release phosphorus sequestered within their substrates as well as other constituents when subjected to a freshwater reintroduction. Project design should minimize potential negative impacts to downstream water quality.

U.S. ARMY CORPS OF ENGINEERS (USACE) ENVIRONMENTAL OPERATING PRINCIPLES

In 2002, the USACE formalized a set of Environmental Operating Principles applicable to decision-making in all programs. The principles are consistent with National Environmental Policy Act (NEPA); the Army Strategy for the Environment; other environmental statutes, and the WRDAs that govern USACE activities. The Environmental Operating Principles inform the plan formulation process and are integrated into all project management processes. A further discussion of how the alternatives were formulated for this project consistent with the Environmental Operating Principles can be found in the main report.

WETLAND VALUE ASSESSMENT (WVA) MODEL

Wetland Value Assessment (WVA) models are ecological benefit models designed to evaluate the existing, Future Without Project (FWOP), and Future With Project (FWP) condition. The WVA produced Average Annual Habitat Units (AAHUs), a measure of change, for the 50-year period of evaluation when comparing the FWP to the FWOP. The Habitat Suitability Index (HSI) is a unitless number bounded by 0 and 1 where 0 represents no habitat and 1 represents optimum habitat.

The WVA calculates the benefits (FWP as compared to the FWOP) for years 0, 1, 10, 25, and 50. The habitat units for each from year 1 to year 50 are calculated. The cumulative habitat units generated for the 50 year period of analysis (2012 - 2062) divided by 50 will determine the AAHU. Thus the WVA accounts for tree growth and the timing for ecological restoration.

ES.4 ALTERNATIVES*

A total of 105 structural and non structural measures and 45 alternatives were considered and evaluated as part of the USACE planning process. All measures and alternatives were evaluated for ecosystem benefits, cost-effectiveness, and environmental impacts. Excluding the No-Action Alternative, the final array of alternatives included seven options, each including openings in the north and/or south banks of the ARDC, bifurcated conveyance channels, sidecasting of dredged material in alternating berms along the proposed conveyance channels, cuts in an existing railroad grade, and both dredged material berm and swamp floor vegetative plantings.

Recommended Plan

Alternative 33, which addresses the most-highly degraded portion of the study area, has been chosen as the Recommended Plan. Alternative 33 is an implementable element of the National Ecosystem Restoration (NER) plan, is within the cost and scope of the authorization, has stand-alone utility, and can be justified based on ecosystem restoration benefits.

Alternative 33 includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast in alternating berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 of a mile north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

Alternative 33 would meet the established objectives by:

- Restoring and benefitting 1,602 acres of freshwater swamp habitat;
- Creating a net of 679 AAHUs;
- Creating 5.0 acres of bottomland hardwood habitat;
- Establishing hydrologic connectivity between the ARDC and the western Maurepas Swamp;
- Reducing the likelihood of the swamp being converted to marsh or open water;
- Promoting the germination and survival of the seedlings of bald cypress and other trees;
- Improving biological productivity and reducing further habitat deterioration.

NATIONAL ECOSYSTEM RESTORATION (NER) PLAN

Alternative 39 was chosen to be the NER plan. This plan includes all the areas in the final array including the areas with the critical need of restoration (have already begun converting to marsh) and an additional area that is expected to need

restoration in the next 20 years. This proposed action provides 1,602 average annual habitat units for the impact areas and represents the long term restoration need for the area. This plan exceeds the WRDA 2007 cost authorization. Features of Alternative 39 include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
- One opening and one conveyance channel in the south bank of the ARDC in SE-1. Dredged material (9.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately two miles south of the ARDC.
- Initial and secondary vegetative plantings of bottomland hardwood/ freshwater swamp tree species on 9.9 acres of dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 925 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

SEA LEVEL RISE

Within the LCA ARDC study area, sea-level rise is predicted to occur from 1.5 ft (0.46 m) to 3.2 ft (0.97 m) over the 50-year period of analysis. In order to gauge the effects of Relative Sea Level Rise (RSLR) on the selected plans, the WVA model was run for Alternative 33 (Recommended Plan) and Alternative 39 (NER) over the 50-year period of analysis. Section 3.8 of the report discusses the impacts of various RSLR estimates on the benefits obtained for the Recommended Plan and NER plans.

ES.5 AFFECTED ENVIRONMENT*

Climate, Geomorphic and Physiographic Setting: The study area is located in the southeastern portion of Louisiana, approximately 30 miles southeast of Baton Rouge, Louisiana. The climate is subtropical marine with long humid summers and short moderate winters. The study area is susceptible to tropical

waves, tropical depressions, tropical storms, and hurricanes. These cause considerable property and environmental damage and loss of human life.

Hurricanes Katrina, Rita, Gustav, and Ike did not have a significant direct impact on the study area; there was little wind and wave damage. These did have an indirect effect due to the introduction of higher-salinity storm surge waters into the impounded swamps within the LCA ARDC study area. This salt intrusion reduces biomass production and impairs health, which increases tree mortality, decreases soil production and integrity, and increases relative subsidence (Coastal Wetlands Planning, Protection, and Restoration Act [CWPPRA] Task Force, 2002). These higher-salinity storm surge waters become impounded by the dredged material berms along the ARDC and are not drained from the swamps. Consequently, salinity is increased in impounded waters and soils in the study area. Increased connectivity through the ARDC dredged material berms would allow the large headwater event that normally follows a tropical storm to flush the higher salinity waters out of the swamp before it has an opportunity to infiltrate into the substrate.

Soils and Waterbottoms: The study area is located in the Maurepas Basin, a component of the Lake Pontchartrain Basin, located near the southern terminus of the Mississippi Alluvial Plain physical province. Construction of the AR&T (1956) flood control project, which includes the ARDC, has impacted the geomorphology of the St. Bernard Delta complex.

Hydraulics and Hydrology: Hydrologic analyses within the study area indicate that the ARDC and its dredged material berms have prevented the adjacent bald cypress-tupelo swamp habitat from receiving nutrient and sediment during high channel flow events and have prevented draining during low channel flow events in the lower Amite River system.

Water Quality and Salinity: Human developments result in wastewater and polluted runoff. The continued conversion of swamp habitat to marsh and open water reduces natural filtration of water. Elevated salinities caused by impoundment of storm-driven higher-salinity waters and the subsequent absorption of salt into the substrate contribute to the degradation of the forested swamp and its conversion to marsh and open water.

Air Quality: The study area was in nonattainment for the interval 2004-2007 for ozone.

Noise: The noise from distant urban areas has little impact on the area. As the population in the study area continues to grow, some noise pollution would occur. The ambient noise caused by boat traffic and human activity in the ARDC, Amite and Blind rivers may cause disturbances.

Vegetation and Wildlife Resources: The study area is considered "coastal wetland," which forms in sheltered coastal environments in conjunction with river deltas, barrier islands, and estuaries. They are rich in wildlife resources and provide nesting grounds and stopovers for waterfowl and migratory birds, as well as spawning areas and valuable habitats for fish. Intertidal and subtidal bottoms are

populated by communities of macrofauna whose structure is dependent upon substrate, salinity, temperature, depth, and ecological relationships.

Benthic, Plankton, Fishery Resources and Essential Fish Habitat (EFH): Construction of the ARDC and dredged material berms has prevented exchange of organisms and water between the swamp and the ARDC.

The benthic community is seasonally abundant, typically during winter months. Phyto-plankton, microscopic plants, and zooplankton can be found in the vicinity of the ARDC and are important for their role in nutrient cycling and are a major source of primary food-energy for most estuarine systems.

The fish species assemblage in the vicinity of the ARDC is primarily composed of freshwater species, with occasional transient marine and diadromous species.

The area provides some habitat for a few euryhaline species, but is not classified as EFH.

Threatened and Endangered Species: The U.S. Fish and Wildlife Service (USFWS), in a letter dated January 20, 2009, identified two threatened and endangered species (Gulf sturgeon and West Indian manatee) and one delisted species (bald eagle) that are known to occur within the area.

Cultural Resources: Five archaeological sites were identified within or immediately adjacent to the study area, including a mound site on the Bayou Chene Blanc bankside, shell middens on Bayou Chene Blanc (two sites) and ARDC (one site north of the study area) banksides, and a shell midden and prehistoric scatter on the lower Amite River bankside. The mound site on Bayou Chene Blanc could not be located and is presumed to be destroyed. Two cultural resources were identified: the railroad grade of the Garyville Northern Railroad (I6LVI 02) and the Amite River Diversion Canal (16LV I03/I6AN84*)* (ARDC). Neither the ARDC nor the railroad grade are eligible for the National Register of Historic Places.

Aesthetics: Aesthetic resources in the study area were negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike. Blind River is a designated Scenic River. The study area encompasses approximately 24,000 acres of undeveloped bald cypress-tupelo swamp habitat in the western Maurepas Swamp. The visual complexity surrounding the study area's waterfront properties, bayous, and coastal swamp habitat provides a pleasing aesthetic to the public eye.

Recreation: Recreational activities such as hunting, trapping, and fishing exist within the study area.

Socioeconomic Resources – Employment: Total employment in Ascension and Livingston parishes is increasing. Employment and income resources are primarily retail, and restaurants.

Socioeconomic Resources – Community Cohesion: The three communities within the study area are Berthelot's Campground, Waterfront East, and Three Rivers Island. The three communities are internally homogeneous and not related to each other.

Socioeconomic Resources – Environmental Justice and Population: Population in the vicinity of Head of Island has 30-40 percent minority composition. The entire study area is characterized by poverty levels of less than 20 percent.

Socioeconomic Resources – Infrastructure: State and local roads, railroad grade, overhead distribution lines, and underground telephone lines traverse the study area.

Socioeconomic Resources – Business and Industry: Six businesses are in the study area. Two unnamed local cypress lumber mills process logs extracted from the region. A Recreational Vehicle (RV) park contains six covered spaces. The Blind River Bar is located south of the ARDC at its confluence with the Blind River and is accessible only by water.

Socioeconomic Resources – Traffic and Transportation: State and local roads traverse the study area. Louisiana Highways 22 and 16 are the major roads in the study area.

Socioeconomic Resources – Public Facilities and Services: The study area is not serviced by a municipal sewer system. Wastewater Treatment of Louisiana, Inc. provides sewer service to the two Blind River Properties developments along the left descending bank of the ARDC. Properties within the study area not served by private companies use septic systems.

Socioeconomic Resources – Local Government Finances, Community and Regional Growth, Tax Revenue and Property Values: Increasing population growth is resulting in increased local government finances, tax revenue and property values. It is also increasing the community and regional growth.

Socioeconomic Resources – Agriculture and Forestry: Approximately 373 acres of agricultural lands, primarily livestock pastures are present. Little timber harvesting occurs within the study area. However, submerged cypress logs are extracted and processed by local timber mills. Recreational activities in the study area include hunting for white-tailed deer, squirrels, rabbit and raccoons; fishing for largemouth bass, bream, and crappie; and trapping alligators and nutria. Some waterfowl hunting occurs in the WMA near the study area.

Merchantable size timber was found only on the ridges in the study area; however, marketability was considered doubtful due to inaccessibility.

Socioeconomic Resources – Public Lands: A portion of the Maurepas Swamp WMA is located within the southwestern study area. Recreational activities in the WMA include hunting, fishing and trapping.

Socioeconomic Resources – Water Use and Supply: The study area for this project lies on the Chicot Equivalent aquifer system, identified by the Environmental Protection Agency (EPA) as a sole-source aquifer. The study area also lies on the southern edge of both the Evangeline Equivalent aquifer system and the Jasper Equivalent aquifer system

Socioeconomic Resources – Navigation: No Federal navigation channels exist within the study area. The Amite River and Bayou Manchac Federal navigation channel is present along the northwestern boundary of the study area.

Navigable waterbodies within the study area include the ARDC, the Petite Amite River, Blind River, and portions of Bayous Pierre and Chene Blanc.

Socioeconomic Resources – Oil, Gas, and Utilities: The western Maurepas Swamp has undergone significant oil and gas exploration activity. However, most oil and gas exploration and production activities in the region have occurred southwest of the study area.

Socioeconomic Resources – Flood Control and Hurricane Protection Levees: The AR&T flood control project was completed in 1964. Municipal and parish flood control measures, including drainage canals and control structures are present.

Socioeconomic Resources – Commercial Fisheries and Oyster Leases: The fishes of the LCA ARDC study area primarily consist of freshwater species, with occasional transient marine and diadromous species. There are no oyster leases located within the study area.

Environmental and Hazardous Toxic and Radiological Waste (HTRW): A limited HTRW survey and Phase I Environmental Site Assessment were conducted for the study area to identify recognized environmental condition (REC) sites or potential REC sites in connection with the study area. None of the potential REC sites would be likely to expose the public or construction workers to HTRW or to adversely affect the project.

ES.6 ENVIRONMENTAL CONSEQUENCES*

A comparison of the direct, indirect, and cumulative impacts for alternatives to reverse the trend of degradation in the western portion of the Maurepas Swamp was conducted. The No-Action Alternative is compared to the alternatives retained for detailed analysis. The No-Action Alternative is considered to be the same as the FWOP condition and analyzes the future conditions of the resource over a 50-year period of analysis (2012-2062).

No-Action Alternative: Without Federal action, the swamp habitat surrounding the ARDC would continue the eventual conversion from a freshwater swamp to a freshwater marsh and open water. The direct impacts would be the continued impoundment of swamp water within the study area, decreased hydrologic connectivity, and a transition towards marsh and salinity-tolerant vegetation. The demographics and economic conditions within the study area would remain stable. Storm surges from tropical cyclone events would increase salinity levels, and the frequency of saltwater inundation is expected to increase with RSLR.

Indirect impacts would be the decline of wildlife, fishery, and vegetative resources. Flora and fauna species could experience stress due to saline waters not being flushed from the system, and may change as salt-tolerant species replace fresh water species. Existing swamp habitat would convert to water bottoms and alter the benthic community, decreasing available nutrients and detritus. The habitat quality would degrade, creating a stressful environment for species present.

Diminished viewscapes for the study area would result. Existing and future infrastructure present within the study area would be affected due to land loss. A portion of the Maurepas WMA is the only public lands in the study area and would be affected. There would be increased exposure of existing oil, gas, and utility pipelines to coastal land loss which would increase operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs, as well as increase the required investment in facilities and pipelines. Coastal forest habitat provides protection from tropical cyclone events, consequently, there could be an increase in storm surge and risk of flooding. Wetland loss would impact commercially important species, including black drum, brown and white shrimp, and blue crab, leading to declining abundances.

Cumulative impacts would be shoreline erosion and land loss resulting in a projected conversion of 18,204 acres of swamp to fresh marsh and open water. There would be decreased flows into and out of the swamp, increased water levels due to coastal wetland loss and increased runoff due to increased urbanization of the Pontchartrain Basin. The water and air treatment functions of wetlands would subside. The integrity of existing recreational resources and aesthetics within the study area would be endangered. Property values may fall as wetlands continue to degrade. Public lands would be adversely affected. Localized storm surge and storm wave damages are likely to increase. A loss of commercial fishery habitat is likely. Impacts on all forms of vegetation include continued deterioration and loss of vegetation and wetland habitat acreage. Continued nationwide wetland loss would lead to increased acreage of shallow water bottoms. Benthic populations and plankton would respond to perturbations with a shift towards saline-oriented species. Land loss within the study area threatens the existence and integrity of cultural and historic resources. Loss of vegetation would degrade the visually complex environment and reduce opportunities for viewing wildlife. The degradation and loss of wetlands would contribute to increased maintenance costs of infrastructure. Current subdivisions within the study area may expand, creating additional roads, bridges and utilities. As populations migrate to coastal communities, investment in hurricane and flood control levees, pump stations, and other flood control facilities are likely to increase.

Alternative 33 (Recommended Plan): Implementation of Alternative 33 (Recommended Plan) would reverse the conversion of swamp habitat to open water and would improve 1,602 acres of swamp habitat and create 5.0 acres of upland habitat within the study area.

Direct impacts would result from construction activities associated with the removal of the existing dredged material berm, dredging of new conveyance channels, and placement of dredged material to create bottomland hardwood islands along conveyance channels. The appropriate Best Management Practices (BMPs) would be implemented to limit introduction of sediments. Cutting through the berms and stockpiling dredged sediments would directly impact water quality by introducing sediments. Sediment introduction would temporarily increase total suspended and dissolved solids, turbidity, as well as increase total metals and

nutrients. There would be an increase in water flow into and out of the swamp depending on ARDC stages, tidal activity and flow. Water level fluctuations would occur in swamp habitats adjacent to ARDC. Restoring hydraulic connectivity would temporarily and periodically allow impounded swamp waters that are low in dissolved oxygen and high in biochemical oxygen demand (BOD), chlorides and nutrients to enter the waterways. Vegetative plantings would necessarily involve human access into areas that have rarely been disturbed. Fresh water would be introduced into the forested swamp, reducing salinity, chloride, and total dissolved solids concentrations. Initial and future periodic releases of waters of potentially higher salinities from the impounded areas may impact the flowing water bodies by temporarily increasing these parameters in the areas surrounding the cuts. Ambient air quality impacts would be temporary and localized, resulting from emissions of construction equipment, but would be negligible. Noise impacts may impact fish and wildlife species, but these would generally avoid the construction area. Construction activities would directly affect vegetation in the areas of the new conveyance channels and cuts in the existing ARDC dredged material berm. Riparian habitat would be created along the conveyance channels, and wetland vegetation would be planted. Direct impacts to benthic resources and plankton would be associated with construction activities including dredging and placement of borrow material. Precautions have to be taken with regard to the Gulf sturgeon, West Indian manatee and bald eagle. Viewscapes would temporarily be disturbed by construction activities.

Indirect impacts would include improved hydrological connectivity between the ARDC and the adjacent swamp. This would allow nutrients and sediments to be introduced from the ARDC into the swamp during flood events and would improve biological productivity and reduce the chances of further habitat deterioration or conversion to marsh or open water. Dissolved organic compounds and detritus would increase. The ARDC's Fish and Wildlife Propagation use is currently listed as impaired due to mercury, chloride and total suspended solids. The release of swamp waters into the system may cause continued impairments. Implementation is expected to improve water quality, thereby improving growth and health of the cypress-tupelo forest. The cycle of inundation and drying of the swamp would be partially restored, helping to prevent salt water intrusion and degradation of the forested wetland. Particulates and gaseous air pollutants would be reduced, increasing air quality. Smothering of benthic organisms may also occur from dredge plume resettlement, but these impacts would be minimized through the use of silt curtains or other measures. Increased nutrients and detritus would provide increased benefits to plankton. Algal blooms may occur if phosphorus sequestered in swamp sediments is released into surface waters. Land loss and erosion prevented would benefit threatened cultural and historic resources in the area. High quality emergent wetland viewscapes would increase visual complexity. An increase in substrate quality would result in the preservation and retention of existing infrastructure. Environmental easements would be placed within the areas of impact. A restoration of coastal forest habitat would occur.

Cumulative impacts would be the effects of this alternative with the additive combination of impacts and benefits for overall net acres nourished and protected by other Federal, state, local and private restoration efforts. A net total of 1,602 acres of wetland soils would be hydrologically restored and nourished; 2.6 acres of soils along ARDC berms and 28.6 acres of existing swamp soils would be impacted by the construction of conveyance channels; however these sediments would be used to construct 5.0 acres of bottomland hardwood islands. The amount of deepwater waterbottoms created from the construction of the conveyance channels would be 18.6 acres. Dissolved organic compounds and detritus from the swamp would increase. The water purification function of a swamp would increase. Water quality and the overall health of the forested swamp would improve. Noise levels would return to preconstruction conditions. Upland habitat would be created and would simulate existing upland and riparian habitat. Wetland creation and nourishment would alter the plankton and benthic community and would result in greater resources for these organisms. Appealing viewscapes supporting eco-tourism as one travels Louisiana's remote areas would be maintained. There would be a reduced level of infrastructure damages and relocation compared to the No-Action Alternative. Environmental easements would be implemented within the areas of impact. The restoration of the forest would result in localized storm surge protection and a decrease in wave heights. Overall, the fishing industry would be more stable near the study area due to a long-term increase in the quality of fisheries habitat.

Alternative 34: Impacts resulting from the implementation of Alternative 34 would be similar to those of Alternative 33 (Recommended Plan), except 1,459 acres of swamp habitat would be improved and 2.7 acres of upland habitat would be created.

Alternative 35: Impacts resulting from the implementation of Alternative 35 would be similar to those of Alternative 33 (Recommended Plan), except 820 acres of swamp habitat would be improved and 2.2 acres of upland habitat would be created.

Alternative 36: Impacts resulting from the implementation of Alternative 36 would be similar to those of Alternative 33 (Recommended Plan), except 3,061 acres of swamp habitat would be improved and 7.8 acres of upland habitat would be created.

Alternative 37: Impacts resulting from the implementation of Alternative 37 would be similar to those of Alternative 33 (Recommended Plan), except 2,279 acres of swamp habitat would be improved and 4.9 acres of upland habitat would be created.

Alternative 38: Impacts resulting from the implementation of Alternative 38 would be similar to those of Alternative 33 (Recommended Plan), except 2,422 acres of swamp habitat would be improved and 7.2 acres of upland habitat would be created.

Alternative 39: Impacts resulting from the implementation of Alternative 39 would be similar to those of Alternative 33 (Recommended Plan),

except 3,881 acres of swamp habitat would be improved and 9.9 acres of upland habitat would be created.

ES.7 PUBLIC INVOLVEMENT*

The following public involvement has occurred during the study phase of this project.

- A Notice of Intent (NOI) to prepare a Supplemental EIS (SEIS) for the LCA ARDC Modification Feasibility Study was published on December 22, 2008.
- A public scoping meeting was held in accordance with NEPA on February 12, 2009.
- A meeting was held with Mr. Glen Martin, part owner of Blind River Properties Inc. and majority land owner within the LCA-ADRC study area, on August 31, 2009, in which preliminary project alternatives were presented to gain his input.
- A second public meeting was held on June 24, 2010 in French Settlement Louisiana.
- Both the Lake Pontchartrain Basin Foundation and the Coalition to Restore Coastal Louisiana expressed support for the LCA ARDC Modification project in a joint letter to the commander of the New Orleans office of the USACE, February 20th, 2009.
- On November 2, 2009 a meeting was held with the Louisiana Conservation Fund (LCF) and the Audubon Society at their request to discuss LCA ARDC efforts.
- Separate meetings were held between representatives of Ascension and Livingston Parish and members of the LCA ARDC PDT on August 6, 2009 and February 4, 2010 in order to solicit feedback on the project objectives and to report on the progress to date. Continual coordination between the LCA ARDC Project Delivery Team (PDT) and Parish representatives has occurred. Additional meetings have been held with Livingston Parish to prepare for the potential coordination between the Hydrologic Restoration in Swamps West of Lake Maurepas CIAP and the LCA ARDC projects.

The Integrated Feasibility Report and Supplemental Environmental Impact Statement was released to the public in May 2010, followed by a 45-day public review period.

ES.8 COORDINATION AND COMPLIANCE*

Following completion of the Final Integrated Report, the Assistant Secretary of the Army for Civil Works will most likely issue a ROD concerning the proposed action. Full compliance with statutory authorities will be accomplished upon review of the Final Integrated Feasibility Report and SEIS by appropriate agencies and the

public and the signing of the ROD, in compliance with NEPA. The USACE has coordinated with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries as per the Fish and Wildlife Coordination Act. A final Coordination Act Letter Report has been received.

ES.9 AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

Meetings and discussions with the public and local, state and federal agencies and the Project Development Team (PDT) indicate support for the project and did not identify any areas of controversy or unresolved issues. The implementation of the recommended plan (Alternative 33) would result in long-term, sustainable ecosystem restoration. Fish and wildlife habitat would be restored and maintained. The project outputs are cost-effective and consistent with the Recommended Plan. This plan is acceptable to the public and the State of Louisiana.

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time. The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources projects and studies within the Louisiana coastal area. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available. If at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

ES.10 CONCLUSIONS AND RECOMMENDATIONS*

The recommended plan (Alternative 33) includes the creation of three conveyance channels through the dredged material berm of the ARDC to improve connectivity that would increase the movement of freshwater, sediments, and nutrients to and from the cypress-tupelo swamp. This plan is both cost-effective and environmentally beneficial and addresses the most critical habitats in the study area. The recommended plan would create 679 AAHU, restore 1,602 acres of cypress-tupelo swamp habitat and create 5.0 acres of bottomland hardwood habitat. The MCACES fully funded cost is estimated at $8,540,000 and the average annualized cost per AAHUs is estimated to be $660. This restoration would benefit fish and wildlife resources, freshwater swamp habitat, and improve water quality.

The overall benefits of the recommended plan justify the estimated costs for project implementation. This project would be cost shared by the non-Federal sponsor, the Coastal Protection and Restoration Authority (CPRA) at 35 percent non-Federal and 65 percent Federal. The total Federal share would be $5,610,000 and the non-Federal share would be $2,930,000. Additionally, the non-Federal sponsor will be 100 percent responsible for the OMRR&R costs of the project which is estimated to be $10,000 annually. Monitoring costs, which are estimated to be $2,970,000 over 10 years would be cost shared at 35 percent non-Federal and 65 percent Federal.

1.0 STUDY INFORMATION

1.1 STUDY AUTHORITY

The Amite River Diversion Canal (ARDC) Modification project was identified in the *Louisiana Coastal Area* (LCA), *Louisiana Ecosystem Restoration Study* (USACE 2004; 2004 LCA Plan). The 2004 LCA Plan was recommended to Congress by a Chief of Engineers report dated January 31, 2005, which called for a coordinated, feasible solution to the identified critical water resource problems and opportunities in coastal Louisiana.

The 2004 LCA Plan and the January 2005 Chief of Engineers report included the following recommendations:

1. Specific Congressional authorization for five near-term critical restoration features,

2. Programmatic authorization of various programs, demonstration projects and investigations.

3. Approval of investigations and preparation of necessary feasibility-level reports for 10 additional near-term critical restoration features, for future potential Congressional authorization. The ARDC Modification project was included in this list of 10 additional projects.

Title VII of the Water Resources Development Act (WRDA) 2007: (Public Law 110-114, 121 STAT. 1270) authorizes the LCA program. In total, the LCA program has authority for 25 projects falling into various components including investigations, research, demonstrations, and construction. The authority includes requirements for comprehensive coastal restoration planning, program governance, project modification investigations, a Science and technology (S&T) program, restoration project construction, a program for beneficial use of dredged material, feasibility studies for restoration plan components, and other program elements. The 10 projects recommended in the 2004 LCA Plan for further analysis and conditionally authorized for construction by WRDA 2007. Furthermore, the six projects listed under Sec 7006(e)(3) were provided with the conditional construction authorization pending a favorable Chief's Report by December 31, 2010.

According to WRDA 2007 the study authority is the following:

SEC. 7003. LOUISIANA COASTAL AREA.

(a) IN GENERAL.—The Secretary may carry out a program for ecosystem restoration, Louisiana Coastal Area, Louisiana, substantially in accordance with the report of the Chief of Engineers, dated January 31, 2005.

SEC 7006. CONSTRUCTION.

. . . (e) ADDITIONAL PROJECTS. —

. . . (3) PROJECTS SUBJECT TO REPORTS.—

(A) FEASIBILITY REPORTS. -- Not later than December 31, 2008, the Secretary shall submit to Congress feasibility reports on the following projects referred to in the restoration plan:

(i) Multipurpose Operation of Houma Navigation Lock at a total cost of $18,100,000.

(ii) Terrebonne Basin Barrier Shoreline Restoration at a total cost of $124,600,000.

(iii) Small Diversion at Convent/Blind River at a total cost of $88,000,000.

(iv) Amite River Diversion Canal Modification at a total cost of $5,600,000.

(v) Medium Diversion at White's Ditch at a total cost of $86,100,000.

(vi) Convey Atchafalaya River Water to Northern Terrebonne Marshes at a total cost of $221,200,000.

(B) CONSTRUCTION.—The Secretary may carry out the projects under subparagraph (A) substantially in accordance with the plans and subject to the conditions, recommended in a final report of the Chief of Engineers if a favorable report of the Chief is completed by not later than December 31, 2010.

(4) CONSTRUCTION. —No appropriations shall be made to construct any project under this subsection if the report under paragraph (2) or paragraph (3), as the case may be, has not been approved by resolutions adopted by the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Environment and Public Works of the Senate.

WRDA Implementation guidance for the 7006(e)(3) studies was issued in July of 2009 and directs the 7006(e)(3) studies to have a favorable Chief's Report by December 2010. The guidance did not discuss the 2008 report requirement. Nevertheless in 2008, U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans MVN provided ASA with a letter report for Congress informing them MVN would not be submitting a report in 2008, but would be complying with the 2010 deadline set forth in WRDA 2007.

WRDA Section 7003 directs that the projects would be carried out substantially in accordance with the 2005 Chief of Engineers report. The 2004 LCA Ecosystem Restoration report recommended the following action for the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project:

Increase Amite River Diversion Canal influence by gapping banks

This restoration feature involves the construction of gaps in the existing dredged material banks of the Amite River Diversion Canal. The objective of this feature is to allow floodwaters to introduce additional nutrients and sediment into western Maurepas Swamp. The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. This feature would provide nutrients and sediment to facilitate organic deposition in the swamp, improve biological productivity, and prevent further swamp deterioration.

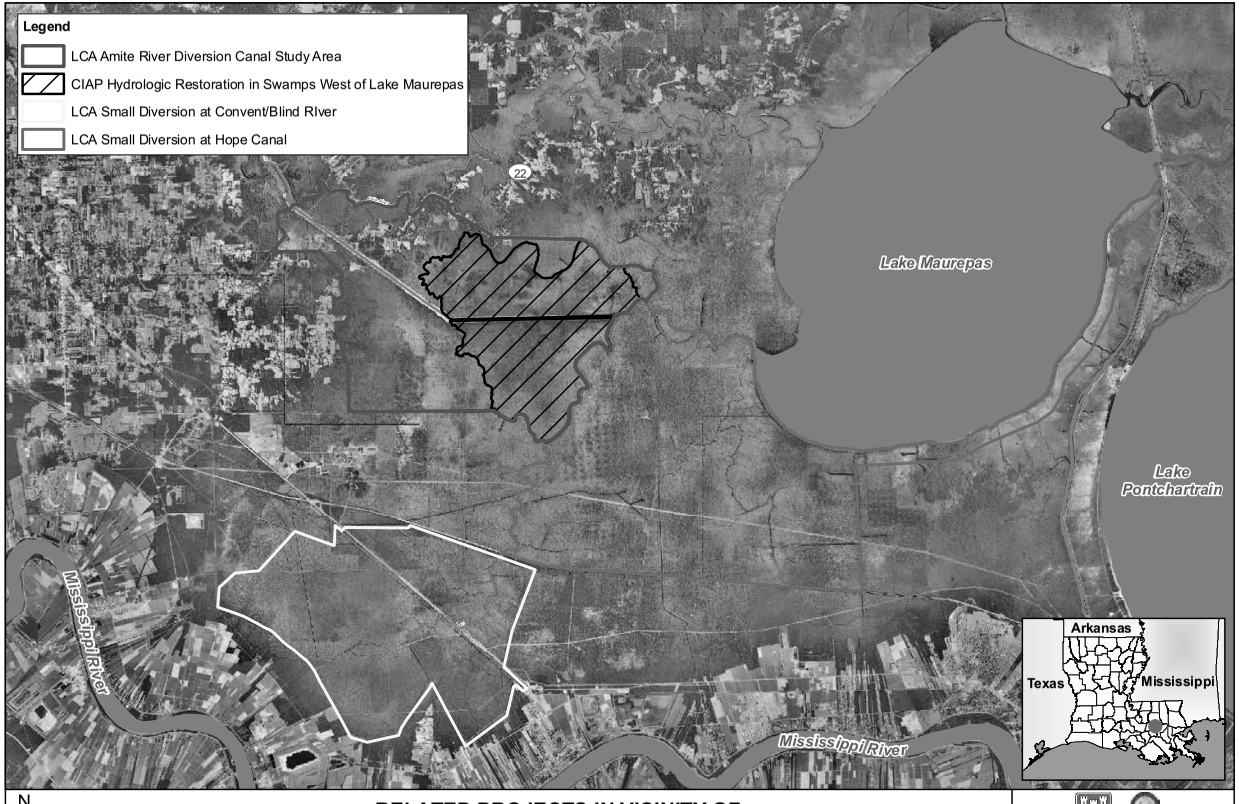
Prior studies and reports have documented degradation in the swamp adjacent to the ARDC and have demonstrated a need for ecosystem restoration that simulates historical hydrologic conditions. This project would evaluate different methods for establishing hydrologic connectivity between the ARDC and the western Maurepas Swamp, allowing the swamp to drain during seasonal low-flow conditions in the Amite River and promoting the germination and survival of the seedlings of bald cypress and other trees. This connectivity would also allow nutrients and sediments to be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events. Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat deterioration. Finally, the establishment of hydrologic connectivity would reduce the likelihood of the swamp converting to marsh or open water.

In keeping with the LCA goals, the LCA ARDC Modification project is an ecosystem restoration project which focuses on near-term solutions. Delaying any proposed restoration action could result in a loss of restoration opportunities and could limit the benefits available for this project.

This project would complement but is independent of two other proposed LCA projects (LCA Small Diversion at Hope Canal and LCA Small Diversion at Convent/Blind River) and two proposed Coastal Impact Assistance Program (CIAP) projects (Hydrologic Restoration in Swamps West of Lake Maurepas and Bald Cypress/Tupelo Coastal Forest Protection (Not illustrated in Figure)) (Figure 1.1). The LCA ARDC Project Delivery Team (PDT) coordinated with the staff of these other projects to identify all known interactions between projects.

1.2 PURPOSE AND SCOPE

This document serves as the Integrated Feasibility Report and National Environmental Policy Act (NEPA) documentations for the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project. Section 7006(e)(3) of the WRDA 2007, Ecosystem Restoration Projects Study (hereafter referred to as the LCA ARDC Supplement Environmental Impact Statement [SEIS]) outlines the study elements requiring Congressional reporting that will be undertaken in



RELATED PROJECTS IN VICINITY OF AMITE RIVER DIVERSION CANAL MODIFICATION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2007 Ascension, Livingston, St. James, St. John, and Tangipahoa Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 1.1
Date: April 2010
Scale:1:220,000
Source: NAIP/GEC
Map ID: 27850108-1381

partnership between the United States Army Corps of Engineers (USACE) and the State of Louisiana.

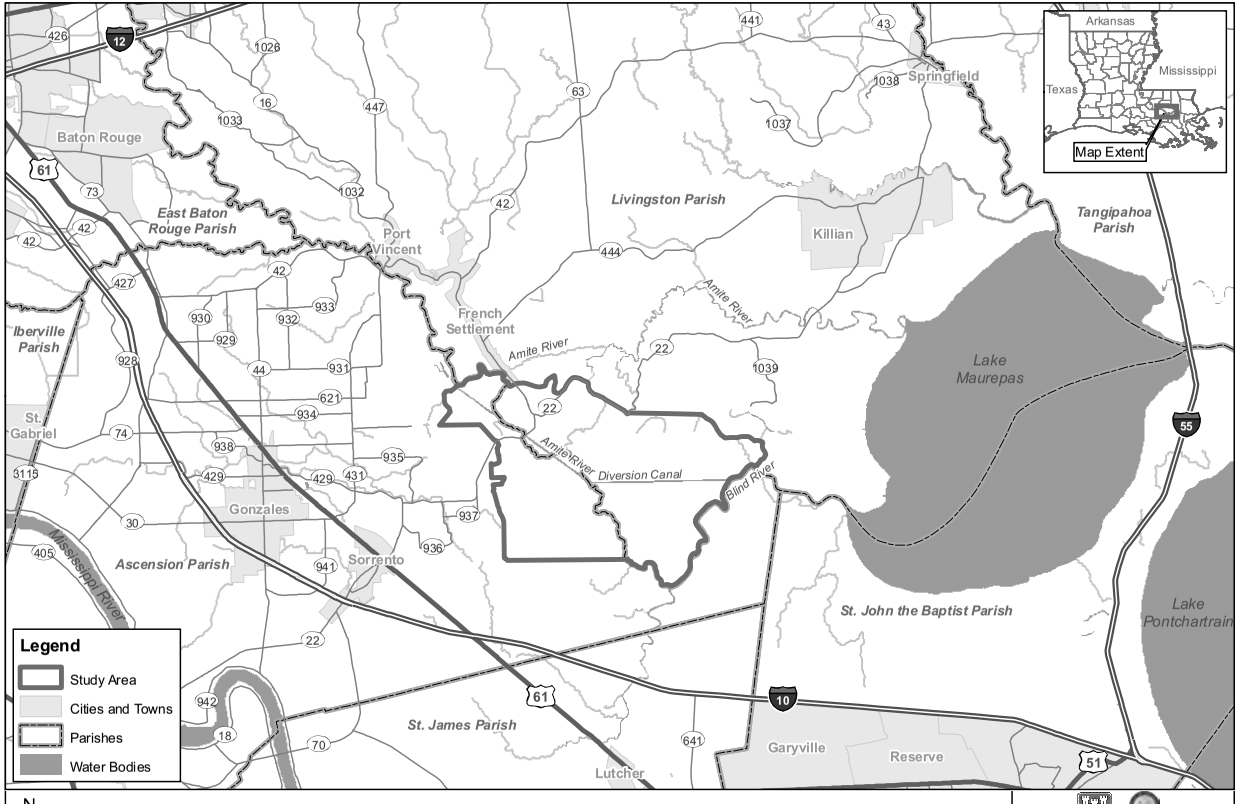
The LCA ARDC Feasibility Study is being developed as a supplement to the *LCA Louisiana - Ecosystem Restoration: Comprehensive Coast-wide Ecosystem Restoration Study* (LCA Near-term Restoration Plan) and is intended to meet the requirements of the Section 7006(e) of the WRDA 2007. This feasibility study is anticipated to result in a Chief of Engineers Report containing a recommended plan (Plan). The Plan addresses systematic restoration of bald cypress-tupelo swamp in areas affected by the Amite River Diversion Canal (ARDC), and considers measures to reduce future bald cypress-tupelo swamp degradation and conversion, restore sheet flow impaired by dredged material bank construction, and protect vital socioeconomic and public resources. The Plan addresses ecosystem restoration exclusively, and does not impair or alter the flood control capabilities of the ARDC. The Plan is independent of, but synergistic with, other LCA near-term critical features, as well as coastal restoration projects proposed under other authorities to provide a holistic approach to restore impaired swamp habitat in the western Maurepas Swamp (see section 1.5).

The environmental consequences of the proposed project are evaluated in Section 5 of this report. The integrated NEPA documentation/SEIS presented here is a supplement to the Final Programmatic Environmental Impact Statement, LCA Ecosystem Restoration Study (FPEIS). The Record of Decision (ROD) for the FPEIS was signed on November 18, 2005. The FPEIS is hereby incorporated by reference.

1.3 STUDY AREA

In the 1950s, the USACE, in an effort to relieve flooding along the upper Amite River, authorized the construction of the ARDC to enhance the flow of water from the meandering Amite River to Lake Maurepas. The 10 mile long canal is 300 feet wide and was dug to a depth of 25 feet. The LCA ARDC study area (Figures 1.2 and 1.3) is located in LCA Subprovince 1 (USACE 2004) and is situated along the ARDC in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal; and is located in the following sections:

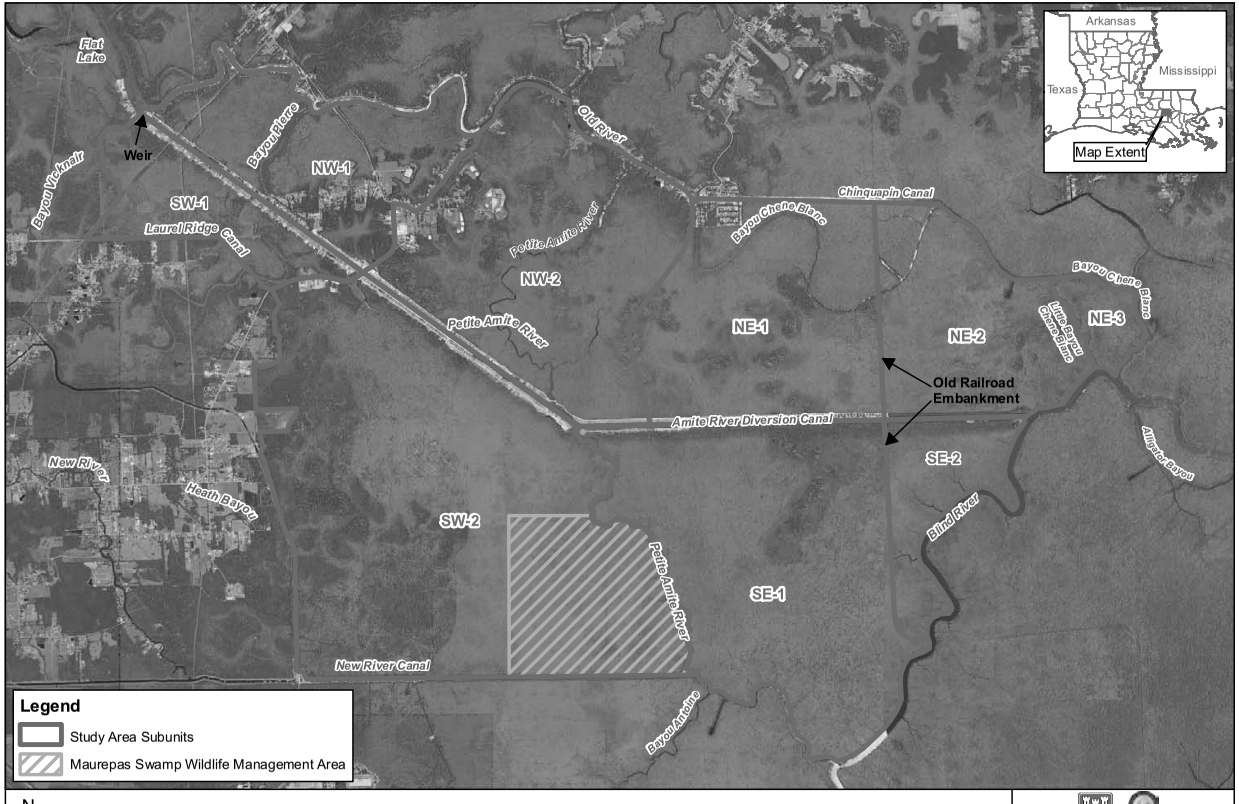
- Township 9 South, Range 4 East, Sections 9-16, 22-27, and 34-36;
- Township 9 South, Range 5 East, Sections 7, 14-36;
- Township 9 South, Range 6 East, Section 30;
- Township 10 South, Range 4 East, Sections 1-3 and 10-12; and
- Township 10 South, Range 5 East, Sections 2-11.



STUDY AREA REGION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 1.2
Date: October 2009
Scale: 1:260,000
Source: USDA/GEC
Map ID: 27850108-1781



STUDY AREA AND SUBUNITS

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 1.3
Date: July 2010
Scale: 1:80,000
Source: USDA/GEC
Map ID: 27850108-1780

For planning purposes, the LCA ARDC study area has been divided into nine separate hydrologic subunits. Each subunit was developed based on hydrologic differences (Appendix L) that exist throughout the study area due to natural and manmade hydrologic boundaries (Table 1.1). These boundaries include natural topography such as natural ridges and waterways, as well as manmade features such as dredged material berms and waterways.

1.4 HISTORY OF INVESTIGATION

In 1999, the State of Louisiana and the Federal agencies charged with restoring and protecting Louisiana's coastal wetlands released a plan to restore coastal Louisiana entitled "Coast 2050: Toward a Sustainable Coastal Louisiana" plan. In response to the Coast 2050 Plan USACE developed the May 1999 report, entitled Section 905(b) ([Water Resource Development Act] (WRDA) 1986) Analysis Louisiana Coastal Area, Louisiana -- Ecosystem Restoration. This reconnaissance-level effort evaluated the Coast 2050 Plan as a whole and expressed a Federal interest in proceeding to the feasibility phase. In 2000, it was envisioned that a series of feasibility reports would be prepared over a 10-year period. As a result, the USACE and the State of Louisiana initiated the Louisiana Coastal Area (LCA) Comprehensive Coastwide Ecosystem Restoration Study to coordinate the separate studies. In FY 2004, recognition of Federal and state funding constraints and scientific and engineering uncertainties pertaining to some of the restoration features under consideration led to the determination that the coastal area ecosystem restoration effort should begin with the development and implementation of a restoration plan that identifies highly cost effective restoration features that address the most critical needs of coastal Louisiana, as well as large-scale and long-term restoration concepts. The resulting near term restoration plan was released in 2004 as the LCA, Louisiana Ecosystem Restoration Study. This study was identified in the 2004 LCA report and authorized by WRDA 2007. The previous reports and plans are further described in Section 1.5.

In November 2008, the USACE and the State of Louisiana represented through the Coastal Protection and Restoration Authority (CPRA) executed a single Feasibility Cost-Share Agreement (FCSA) covering the six LCA near-term plan projects listed in Section 7006(e) of the WRDA 2007. The six features each underwent a separate feasibility analysis and environmental compliance review.

1.5 PRIOR REPORTS AND EXISTING PROJECTS

A number of prior water resources development efforts are relevant to the LCA Near-term Restoration Plan. Table 1.2 lists these efforts and denotes how each is relevant to the ARDC, Louisiana study followed by a discussion of each report or project.

Table 1.1. Hydrologic Subunits

Hydrologic Subunit	Acres	Description
NW-1	2,332	This subunit is one of the healthier portions of the western Maurepas Swamp and is connected hydrologically by Bayou Pierre and the Amite River. This area also contains an extensive housing development. It is surrounded by Old River to the north, the ARDC to the south, and a developed natural ridge to the east.
NW-2	4,289	This subunit contains the healthiest portion of the western Maurepas Swamp. It is surrounded by Old River to the north, the ARDC to the south, a developed natural ridge to the west, and a natural ridge to the east. It is connected hydrologically by Old River and the Petite Amite River.
NE-1	3,351	This subunit exhibits some degradation and has little to no hydrologic connectivity with the ARDC, but is hydrologically connected by Bayou Chene Blanc and the Chinquapin Canal. The subunit is surrounded by the Chinquapin Canal to the north, the ARDC to the south, an abandoned railroad embankment to the east, and an undeveloped natural ridge to the west
NE-2	2,309	This subunit has a high degree of habitat degradation and has little to no hydrologic connectivity with the ARDC. The subunit is surrounded by the Chinquapin Canal to the north, an abandoned railroad embankment to the west, the ARDC to the south, and Little Bayou Chene Blanc and Blind River to the east. This subunit is highly degraded and is one of the areas in most need of restoration.
NE-3	358	This subunit has some degree of habitat degradation and is hydrologically connected by Bayou Chene Blanc, Little Bayou Chene Blanc. A portion of Blind River, which is hydrologically connected to this subunit as well, borders to the south.
SW-1	1,300	This subunit contains a series of culverts that provide hydrologic connectivity between the swamp and the ARDC and is one of the healthier portions of the western Maurepas Swamp. The subunit is bordered by the ARDC to the north and natural ridges to the south and west.
SW-2	8,106	This subunit appears to have some areas of degradation along with some areas of healthy swamp. The subunit is hydrologically connected by the Petite Amite River to the east and New River Canal to the south. It is also bordered by the ARDC to the north, and a developed natural ridge to the west.
SE-1	4,875	This subunit exhibits some degradation, mainly due to the lack of freshwater, sediment, and nutrient input caused by the ARDC dredged material berms. This subunit is hydrologically connected by Blind River on the south and the Petite Amite River to the west side. This subunit is bordered by the ARDC to the north and an abandoned railroad embankment to the east.
SE-2	1,062	This subunit exhibits some degradation, mainly due to the lack of freshwater, sediment, and nutrient input caused by the ARDC dredged material berms. The subunit is surrounded by the ARDC to the north, an abandoned railroad embankment to the west, and Blind River to the east. This subunit is highly degraded and is one the areas in most need of restoration.

Table 1.2. Relevance of Prior Studies, Reports, Programs, and Water Projects to the LCA ARDC Integrated Feasibility Report and EA

Prior Studies, Reports, Programs, and Water Projects	Relevance to LCA ARDC				
	Data Source	Consistency	Structural Measures	Non-Structural Measures	Future Without Project Condition
Comprehensive Planning Studies					
Coast 2050, 1999	X		X	X	
LCA Near-term Restoration Plan, 2004	X	X	X	X	X
Louisiana's Comprehensive Master Plan for a Sustainable Coast, 2007	X	X	X	X	X
Louisiana Coastal Protection and Restoration (LACPR), 2009	X	X	X		
Prior Studies, Reports and Water Projects					
Amite River and Bayou Manchac, 1928	X	X			X
Mississippi River and Tributaries (MR&T), 1928	X	X			X
Amite River and Tributaries (AR&T), 1956	X	X			X
Comite River Diversion	X	X			X
LCA Near Term Critical Restoration Features					
• LCA Small Diversion at Hope Canal (1,500 – 2,000 cfs)	X	X	X	X	X
• LCA Small Diversion at Convent/Blind River (1,000 – 5,000 cfs)	X	X	X	X	X
Coastal Impact Assistance Program (CIAP) Projects					
• Hydrologic Restoration in Swamps West of Lake Maurepas	X	X	X	X	X
• Bald cypress/Tupelo Coastal Forest, Pontchartrain Basin	X	X	X	X	X
CWPPRA Projects Authorized for Design	X	X	X	X	X
Related Laws and Programs					
Louisiana Coastal Management Program, 2008	X	X			
Louisiana Coastal Wetlands Conservation, Restoration and Management Act, 1989	X	X			
The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), 1990	X	X	X	X	X
The Coastal Impact Assistance Program (CIAP), 2001 and 2005	X	X	X	X	X
Act 8 of the First Extraordinary Session of 2005	X	X			
Various Plans and Programs of Non-Government Organizations	X		X	X	X

1.5.1 Federal

Amite River and Tributaries (AR&T), 1956: The ARDC was authorized by Congress in 1956 as a component of the AR&T Federal flood control project. The

ARDC was constructed from mile 25.3 of the Amite River to mile 4.8 of the Blind River. The ARDC is 10.6 miles long, 300 feet wide, and was originally dredged to 25 feet deep. The ARDC is connected to the Amite River by a control weir at French Settlement that was designed to retain low flows in the Amite River. A small navigation channel through the control weir allows small boats to pass to and from the river and the ARDC. Maintenance of portions of the AR&T within their respective boundaries is the responsibility of the Ascension and Livingston Parish Councils and the East Baton Rouge Parish Council. Construction of this project was initiated in 1957 and completed in 1964. No dredging activities have occurred in the ARDC since its construction. The dredged material berms created alongside the ARDC as a result of this project provide interference with natural hydrologic exchange within the LCA ARDC study area.

CWPPRA Project Priority Lists: Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), often referred to as simply "The Breaux Act," was the first Federally mandated restoration effort to take place along Louisiana's coast and the first program to provide a stable source of Federal funds dedicated specifically to coastal restoration.

Various ARDC modification projects have been proposed to the CWPPRA including:

- **CWPPRA's PPL 12 Proposal, 2002:** This initial proposal involved cutting five to 10 gaps in the dredged material berms on both sides of the diversion canal and installing 36-inch or 48-inch culverts at the gap locations for the purpose of facilitating water exchange to increase productivity, regeneration, and sediment accretion within the adjacent cypress and tupelo swamps, and to increase dissolved oxygen in water flowing through the adjacent swamp habitat.
- **CWPPRA PPL 16 Proposal, 2006:** A proposal for gapping the dredged material berms of the ARDC was again submitted to the CWPPRA Task Force for consideration for the PPL 16 on 5 January 2006. The proposal involved the construction of 5 to 10 gaps in the dredged material berms on both sides of the ARDC to facilitate water exchange, while also presenting the option of placing two of the proposed gaps on the banks of the Petite Amite River north of the existing bridge, to avoid existing development along the western portion of the ARDC.
- **CWPPRA PPL 17 Proposal, 2007:** A proposal for gapping the dredged material berms of the ARDC was submitted to the CWPPRA Task Force for consideration for the 17th Priority Project List (PPL 17) on 11 January 2007. The proposal features differed markedly from those of the PPL 12 proposal. The PPL 17 proposal involved the construction of numerous gaps in the dredged material berms of the ARDC, the old railroad grade that traverses the areas of impact to the north and south, and the levees of the Blind River and the Petite Amite River along the study area border to facilitate water

exchange. The proposal indicates that the gaps would be located to maximize water exchange.

Coast 2050 Plan, 1998: In 1998, Federal and state agencies, local governments, academia, numerous non-governmental groups, and private citizens participated in developing the Coast 2050 Plan. The Plan built upon lessons learned through the CWPPRA and other programs. It reflected a growing recognition that a more comprehensive "systemic" approach to restoring coastal wetlands was needed. The Plan formed the basis for the May 1999 905(b) reconnaissance report for the LCA Ecosystem Restoration Study.

LCA Ecosystem Restoration Study, 2004: In 2000, the Nation and State of Louisiana initiated the LCA Ecosystem Restoration Study to address Louisiana's severe coastal land loss problem. The goal of LCA study was to achieve and sustain a coastal ecosystem that can support and protect the environment, economy, and culture of coastal Louisiana and thus contribute to the economy and well-being of the Nation. The LCA study focused on "lessons learned" from previous Louisiana coastal restoration efforts, the Coast 2050 restoration strategies, and the best available science and technology to develop a plan addressing the most critical coastal ecological needs. The *Final Programmatic Environmental Impact Statement, LCA, Louisiana, Ecosystem Restoration Study* was prepared for this study. The LCA ARDC project was identified as a near-term critical restoration feature of the LCA Ecosystem Restoration Plan.

- **LCA Small Diversion at Hope Canal:** The LCA Small Diversion at Hope Canal is located east of the project. The LCA Small Diversion at Hope Canal consists of diverting approximately 1,500 to 2,000 cfs from the Mississippi River into the Hope Canal at Garyville. The Hope Canal will be improved and water management features will be included to distribute the flow into the Maurepas Swamp. The project service area is approximately 36,000 acres (56.25 square miles). The project is currently being investigated under the CWPPRA program as PO-29 River Reintroduction to Maurepas Swamp. The work for this project has not yet begun under the LCA program.

  This project will benefit a different portion of the Maurepas swamp than the LCA ARDC Modification project. Both of the projects are independent but their effects will be additive in restoring the swamp. Figure 1.1 displays the current project still under CWPPRA.

- **LCA Small Diversion at Convent/Blind River:** The LCA Small Diversion at Convent/Blind River project is located south of the project area. The LCA Small Diversion at Convent/Blind River project consists of diverting approximately 1,000-5,000 cfs from the Mississippi River

into the Blind River and the Maurepas Swamp. The objective of this feature is to introduce sediment and nutrients into the swamp to reverse swamp decline in that area.

The LCA ARDC modification project will restore a different portion of the Maurepas swamp than the Small Diversion at Convent/Blind River project (Figure 1.1). The study areas for both projects are hydrologically independent; therefore any proposed actions would not result in ecosystem benefits or impacts between the two projects. The ARDC will add to the restoration benefits of the LCA Small Diversion at Convent Blind River and Small Diversion at Hope Canal projects. All projects will aid in restoring the second largest stand of continuous swamp in Louisiana.

USACE Amite River Diversion Channel Spoil Bank Gapping Preliminary Restoration Plan, 2004: This project was a USACE restoration project under Section 1135. A Preliminary Restoration Plan was developed and completed, but the project went unfunded. This project was to gap the northern dredged material berms in an effort to reintroduce ARDC water into the adjacent swamps.

Louisiana Coastal Protection and Restoration (LACPR), 2009: In 2006, Congress authorized development of a Technical Report for coastal restoration and "Category 5" hurricane risk reduction in south Louisiana. The USACE submitted a Preliminary Technical Report to Congress in July 2006. A Final Technical Report completed in 2009 includes different structural alignments and measures such as floodgates, floodwalls, and levees. The report includes nonstructural measures such as elevating homes. In addition, the report reviews various wetland restoration measures and highlights the role of wetlands in coastal risk reduction.

Coastal Impact Assistance Program (CIAP) Projects, 2008: The Energy Policy Act of 2005 was signed into law on August 8, 2005. Section 384 of the Act establishes the CIAP which authorizes funds to be distributed to Outer Continental Shelf (OCS) oil and gas producing States to mitigate the impacts of OCS oil and gas activities. CIAP projects located within or near the LCA ARDC study area include:

- **Hydrologic Restoration in Swamps West of Lake Maurepas (CIAP):** This proposed project would be located within portions of the LCA ARDC Modification project study area. The CIAP project received study funding in September 2010 to begin design but has not yet been awarded construction funding. The CIAP project proposes to facilitate water exchange between the ARDC and portions of the adjacent Maurepas Swamp. Additionally, the project proposes to facilitate better hydraulic conductivity between portions of the interior Maurepas Swamp and the ARDC. The LCA ARDC Modification project PDT, the CIAP project team, and representatives of Livingston Parish

have coordinated these separate efforts to ensure that implementation of the proposed CIAP project and the LCA ARDC Modification project would result in the maximum benefits for the Maurepas Swamp area. Based on the aforementioned coordination, once the CIAP project is authorized for construction funding, the actions proposed by this project will represent a separate effort from the actions recommended by the LCA ARDC Modification project. To date no formal request for the use of CIAP funds as a cost share for this project has been made.

- **Bald cypress/Tupelo Coastal Forest, Pontchartrain Basin (CIAP):** This proposed CIAP project would be located nearby the LCA ARDC study area. The project proposes to purchase a portion of the existing bald cypress-tupelo swamp in the western Maurepas Swamp northeast of the study area to protect the habitat from future logging. This CIAP project was awarded funding for initial work including land appraisal and legal documents however has not yet been awarded final funding to acquire land.

1.5.2 State

Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast, 2007: Act 8 of the First Extraordinary Session of the 2005 Louisiana Legislature established the CPRA to develop, implement, make reports on, and provide oversight for a comprehensive coastal protection master plan and annual coastal protection plans. The report Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast (Master Plan) was developed to fulfill the mandates of Act 8, which was signed into law in November 2005. The Master Plan presents a series of recommended hurricane protection and coastal restoration measures that, taken together, present a conceptual vision of a sustainable coast based on the best available science and engineering. Measures presented in the plan are divided into three groups: restoring sustainability to the Mississippi River Delta; restoring sustainability to the Atchafalaya River Delta and Chenier Plain; and hurricane protection (structural and non-structural measures). The LCA ARDC project is consistent with restoring sustainability to the Mississippi River Delta.

1.6 PLANNING PROCESS AND REPORT ORGANIZATION

The LCA ARDC Modification project follows the United States Army Corps of Engineers (USACE) six-step planning process specified in Engineering Regulation (ER) 1105-2-100. The planning process identifies and responds to problems and opportunities associated with the Federal objective and specified State and local concerns. This integrated report (FS/SEIS) includes elements of both the planning process and sections specific to the NEPA review of the project.

The chapter headings and order in this report generally follow the outline of the required NEPA documentation for an EIS. Chapters of the report relate to the six steps of the planning process in ER 1105-2-100 as follows:

- **Chapter 2: Need For and Objectives of Action**
  This chapter addresses the first step in the planning process. In the first step of the planning process, the study area problems and opportunities are defined in addition to the constraints, goals, and objectives. An initial statement of problems and opportunities was developed for the 2004 LCA report which reflected the priorities and preferences of the Federal government, non-Federal sponsor, and other stakeholders. This report presents an updated problem identification that includes enhanced understanding of the process and problems of the study area.

- **Chapter 3: Alternatives**
  The third chapter of this report addresses the third, fifth, and sixth steps in the planning process. Step three of the planning process is the formulation of alternative plans. During this step, the plans developed in the 2004 LCA report were reevaluated. The fifth step in the planning process addresses comparisons of the alternative plans with emphasis on the outputs and effects of each alternative. During the sixth step of the planning process, the selection of the recommended plan is made based upon the comparison of the alternative plans.

- **Chapter 4: Affected Environment**
  The fourth chapter of this report addresses the second step of the planning process which requires an inventory and forecast of resources within the study area. The inventory and forecast of the study area provides the without project condition and is the basis of comparison for the alternatives.

- **Chapter 5: Environmental Consequences**
  The fifth chapter of this report covers the fourth step of the planning process which evaluates the effects of the proposed alternative plans in terms of ecosystem benefits. The evaluation criteria are based on the overall goals and objectives of the LCA program and specific planning objectives and purposes of the near-term critical restoration projects recommended in the 2005 Chief of Engineers Report.

1.7 USACE CAMPAIGN PLAN

The USACE has developed a Campaign Plan with a mission to "provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risk from disasters." This Campaign plan is shaping

USACE command priorities, focusing transformation initiatives, measuring and guiding progress, and helping the USACE adapt to the needs of the future.
USACE Campaign Plan Goals and Objectives Summary:

- **Goal 1: Deliver USACE support to combat, stability and disaster operations through forward deployed and reach back capabilities.**
  - Objective 1a: USACE is ready, responsive and reliable in delivering high performance, all hazard, contingency mission execution in a world-wide theater of operations.
  - Objective 1b: Prepare Theater Engineer Commands (TEC) to support Combatant Commanders throughout the spectrum of operations.
  - Objective 1c: Establish human resources and family support programs that promote readiness and quality of life.
  - Objective 1d: Institutionalize USACE capabilities in interagency policy and doctrine.

- **Goal 2: Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders.**
  - Objective 2a: Deliver integrated, sustainable, water resources solutions.
  - Objective 2b: Implement collaborative approaches to effectively solve water resource problems.
  - Objective 2c: Implement Streamlined and Transparent Regulatory Processes to Sustain Aquatic Resources.
  - Objective 2d: Enable Gulf Coast recovery.

- **Goal 3: Deliver innovative, resilient, sustainable solutions to the Armed Forces and the Nation.**
  - Objective 3a: Deliver sustainable infrastructure via consistent and effective military construction and real estate support to customers.
  - Objective 3b: Improve resilience and lifecycle investment in critical infrastructure.
  - Objective 3c: Deliver reliable infrastructure using a risk-informed asset management strategy.
  - Objective 3d: Develop and apply innovative approaches to delivering quality infrastructure.

- **Goal 4: Build and cultivate a competent, disciplined, and resilient team equipped to deliver high quality solutions.**
  - Objective 4a: Identify, develop, maintain, and strengthen technical competencies in selected Communities of Practice (CoP).
  - Objective 4b: Communicate strategically and transparently.
  - Objective 4c: Standardize business processes.

- Objective 4d: Establish tools and systems to get the right people in the right jobs, then develop and retain this highly skilled workforce.

This project addresses two points of the USACE Campaign Plan. The second goal of the USACE Campaign Plan is addressed by this project since it is an element of the LCA ecosystem restoration plan on the Gulf Coast and is part of a collaborative effort with the non-Federal sponsor. This project also addresses the third goal through the application of the planning process to formulate, analyze, and evaluate alternative designs in pursuit of a sustainable, environmentally beneficial, and cost-effective ecosystem restoration design.

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2.0 NEED FOR AND OBJECTIVES OF ACTION

This section presents the results of the first step of the planning process, the specification of problems and opportunities and the establishment of planning objectives and planning constraints, which is the basis for the formulation of alternative plans. The 2004 LCA problems, needs, opportunities and objectives are presented along with the specific problems, needs, opportunities and constraints identified for the LCA ARDC study area project.

2.1 NATIONAL OBJECTIVES

The U.S. Army Corps of Engineers (USACE) planning process is based on the economic and environmental Principals and Guidelines (P&G) promulgated in 1983. The P&G provide for development of reasonable plans that are responsive to National, State, and local concerns. Planning project benefits are quantified in this process as national economic development (NED) output, national ecosystem restoration (NER) output, or a combination of NED/NER output.

For water and land resources planning, the Federal objective is to contribute to NED while protecting the Nation's environment and adhering to national environmental statutes, executive orders, and Federal planning requirements. NED contributions are increases in the net value of the national output of goods and services, expressed in monetary units. These NED outputs are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED may include increases in the net value of marketed and non-marketed goods and services.

Ecosystem restoration is one of the primary goals of the USACE Civil Works Program. The USACE objective in ecosystem restoration planning is to contribute to NER. NER contributions include increases in the net quantity and/or quality of desired ecosystem resources. NER measurements are changes in ecological resource quality as a function of improvement in habitat quality and/or quantity. The units are expressed quantitatively in physical units or indexes that are not based on monetary units. Net changes are measured in the study area and in the rest of the Nation. Single-purpose ecosystem restoration plans shall be formulated and evaluated in terms of their net contributions to increases in NER output. Multipurpose plans that include ecosystem restoration shall contribute to both NED outputs and NER outputs. For multipurpose projects, a plan that trades off NED and NER benefits to maximize the sum of net contributions to NED and NER is usually recommended.

NER contributions were considered in the alternatives analysis for this project. As specified, under Title VII of Water Resource Development Act (WRDA) 2007, any project or separable project element under the Louisiana Coastal Area (LCA) may

be justified by the environmental benefits alone and economic justification is not required if the Secretary determines that the project or activity is cost-effective. This exemption does not apply for any project that is not predominately related to the protection, preservation, and restoration of the coastal Louisiana ecosystem.

2.2 PUBLIC CONCERNS

Public input was received through coordination with the sponsor, coordination with other agencies, public review of draft and interim products, and through workshops, and public meetings. A National Environmental Policy Act (NEPA) scoping meeting was held on Thursday, February 12, 2009 in French Settlement, Louisiana in which LCA plan, the NEPA process and milestones, an overview of the study goals and objectives, and maps of the study area were presented. Overall, the public has expressed its general approval and support for the LCA ARDC Modification project. A discussion of public involvement is included in Section 6, Public Involvement, Review and Consultation. The public concerns were considered and incorporated into the establishment of planning objectives, planning constraints and management measures listed below:

- Weir at French Settlement does not function properly and diverts excessive flow to ARDC, impairing lower Amite River.
- Project should incorporate weir construction at downstream end of ARDC.
- ARDC construction has disrupted natural hydrologic regime and damaged properties.
- Endangered/protected species are present in the study area and vicinity.
- Scope of project should address wildlife and fisheries habitat.
- Hydraulics and Hydrology (H&H) modeling should be expansive, incorporate conditions from other projects, and/or involve stage data collection.
- Project should incorporate rehabilitation of weir at French Settlement.
- Southwestern boundary of study area should be expanded.
- Boat trips to reconnaissance study area are needed.
- Diversion canal stages are primarily influenced by Lake Maurepas.
- Gap placement is an issue because of development on dredge material berms.
- Swamps south of Bayou Pierre are impaired from acidity caused by lack of hydrologic exchange.
- Project is greatly needed and should be completed on an expedited schedule.
- Project should include vegetative planting and nutria control.
- Create hydrologic exchange between Bayou Pierre and ARDC on south canal bank.
- Colonial nesting waterbird rookeries are present in the study area.
- Draining swamp waters may impair water quality in ARDC and downstream.
- Project should operate under flood events, not merely normal flow or high flow conditions.

- Dredge material berm gapping has been implemented as part of waterfront development projects in study area.
- Avoidance or minimization of forest habitat impacts should be considered during gap location.
- Project scope should include restoration of lower Amite River.

The Integrated Feasibility Report and Supplemental Environmental Impact Study (FS/SEIS) was released to the public on May 21, 2010, and was followed by a 45-day public review period ending on July 6, 2010. A public meeting was held on June 24, 2010 in French Settlement Louisiana. Comments received and the responses to them are included in Appendix G.

2.3 PROBLEMS, NEEDS, AND OPPORTUNITIES

This study is designed to address ecosystem restoration problems and opportunities in the LCA ARDC Study Area. These have been documented since 1998 through numerous comprehensive planning studies. Specifically, this study builds upon the following comprehensive planning efforts for the LCA:

- Coast 2050
- Louisiana Coastal Area (LCA) Report
- Louisiana Coastal Protection and Restoration (LACPR) Technical Report
- Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast

Planning for this project uses data from these reports and additional public scoping. Alternative plans will be formulated to build upon these previous plans.

2.3.1 2004 LCA Ecosystem Restoration Report

The 2004 LCA Ecosystem Restoration report summarizes the problems, needs, and opportunities facing coastal Louisiana.

The problems, needs, and opportunities, specific to the LCA ARDC study area, were determined based upon the 2004 LCA report, as well as prior comprehensive planning studies, public input, and inter-agency information exchange. System-wide problems and opportunities were used to identify and define more geographically specific problems and opportunities throughout the LCA ARDC study area (Table 2.1) (see Section 1.5). Through the NEPA public scoping process, the study team solicited input on problems and opportunities from members of the public, government resource agencies, and other stakeholders. A Conceptual Ecological Model (CEM) was also developed to further identify specific study area

Table 2.1. Problems and Opportunities by LCA ARDC Study Area Subunits

Problem	Degree of Problem by Subunit								
	NW-1	NW-2	NE-1	NE-2	NE-3	SW-1	SW-2	SE-1	SE-2
Subsidence	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Sea level Rise	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Tropical Cyclone Events	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Modification of Natural Hydrology:									
Impoundment	Minimal	Minimal	Severe	Severe	Minimal	Minimal	Minimal	Moderate	Moderate
Decreased Freshwater, Sediment, and Nutrient Inputs	Minimal	Minimal	Moderate	Severe	Minimal	Minimal	Moderate	Severe	Severe
Habitat Changes and Land Loss:									
Decreased Productivity	Minimal	Minimal	Moderate	Severe	Severe	Minimal	Moderate	Severe	Severe
Increased Seedling Mortality	Minimal	Minimal	Minimal	Severe	Severe	Minimal	Moderate	Severe	Severe
Increased Habitat Conversion	Minimal	Minimal	Moderate	Severe	Severe	Minimal	Moderate	Severe	Severe
Invasive Species	Minimal	Minimal	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Opportunity	**Subunit**								
	NW-1	**NW-2**	**NE-1**	**NE-2**	**NE-3**	**SW-1**	**SW-2**	**SE-1**	**SE-2**
Improve hydrologic processes impaired by dredged material bank construction, including connectivity, sheet flow, and freshwater nutrient inflow and outflow.			X	X				X	X
Prevent future cypress swamp degradation and transition currently predicted to occur.			X	X				X	X
Improve areas that have been degraded and transitioned to fresh or open water.			X	X				X	X
Protect vital socioeconomic and public resources.			X	X				X	X

problems. The project-specific problems and opportunities are located in Sections 2.3.3 and 2.3.6, respectively, of the report.

2.3.2 Conceptual Ecological Model

The CEM developed for the LCA ARDC Modification project, identifies specific study area problems via diagrammatic relationships between major anthropogenic and natural stressors, biological indicators, and target ecosystem conditions (Appendix I). The LCA ARDC CEM:

(1) Identifies drivers of ecological processes, anthropogenic stressors, and their ecological effects and attributes useful in monitoring and forecasting ecosystem response;
(2) Diagrams qualitative explanations of how human activities alter ecology;
(3) Develops and communicates working hypotheses;
(4) Identifies performance measures; and
(5) Develops monitoring and modeling activities to support restoration and management.

This CEM does not explain all possible relationships or include all possible factors influencing the performance measure targets within natural systems in the study area. Rather, the CEM model displays ecosystem functioning relationships within the study area by presenting only the information deemed most relevant to ecosystem monitoring goals.

The CEM developed for the LCA ARDC Modification project is presented in Figure 2.1. Model components are identified as the following:

- Drivers
  - Canal Construction
  - Hurricanes
- Ecological Stressors
  - Impoundment
  - Lack of Riverine Input and Connectivity
  - Storm Surge
- Ecological Effects
  - Trees Stressed and Die
  - Increased Seedling Mortality
  - Loss of Nutrients and Sediments
  - Decreased Water Quality and Increased Salinity
  - Decreased Productivity
  - Increased Habitat Conversion

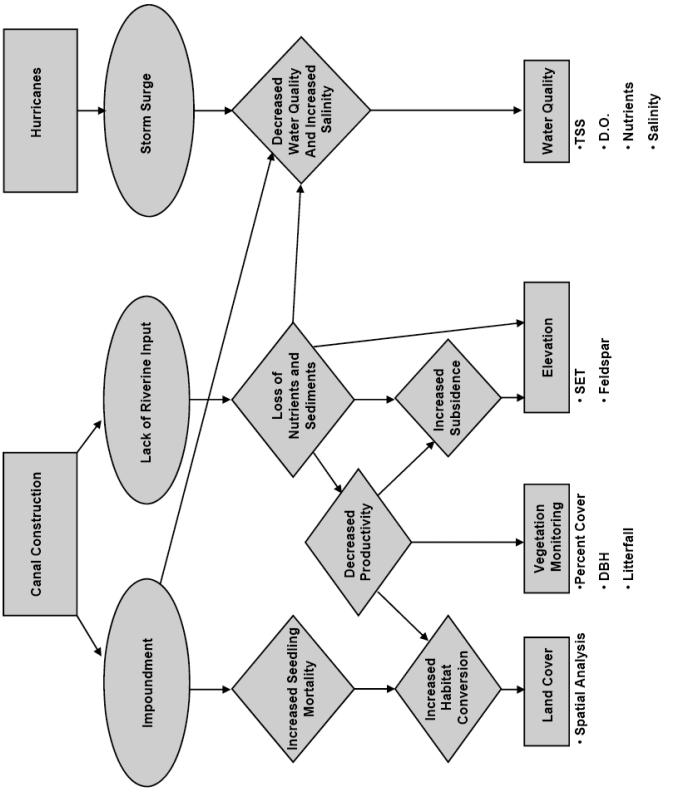


Figure 2.1. Conceptual Ecological Model, Amite River Diversion Canal Modification Project

- Increased Subsidence

- Attributes and Performance Measures
  - Land Cover
  - Vegetation Monitoring
  - Elevation
  - Water Quality

The Wetland Value Assessment (WVA) model was used to evaluate the environmental benefits of the final array in Section 3. The WVA measures functional benefits for the Future With Project (FWP) as compared to Future Without Project (FWOP) (see Section 3.5.2). While the CEM does not directly provide quantitative data for the WVA, the CEM provides the ecological principles that are quantitatively captured by the WVA.

2.3.3 Problems

According to the 2004 LCA Ecosystem Restoration Study, the measurable increase in coastal land loss in the mid- to late- 20th century can be linked to human activities that have fundamentally altered the deltaic processes of the coast and limited their ability to rebuild and sustain it. In the Chenier Plain, human activities have fundamentally altered the hydrology of the area, which has impacted the long-term sustainability of the coastal ecosystems. Because of the magnitude and variety of these human-induced changes, and their interaction with natural landscape processes, all of the factors contributing to coastal land loss and ecosystem degradation must be viewed together to fully understand how Louisiana's coastal ecosystem shifted from the historical condition of net land gain to the current condition of accelerated net land loss.

According to the 2004 LCA report, the natural processes of subsidence, habitat switching, and erosion of wetlands, combined with a widespread human alteration, have caused significant adverse impacts to the Louisiana coastal area, including increased rates of wetland loss and ecosystem degradation. Without action, Louisiana's healthy and highly productive coastal ecosystem, composed of diverse habitats and wildlife, is not sustainable. Man-made alterations have impacted the natural sustainability and quality of the Louisiana coastal ecosystem. This loss of sustainability has manifested itself as accelerated land loss. If recent loss rates continue into the future, even taking into account current restoration efforts, coastal Louisiana is projected to lose an additional 328,000 acres of coastal marshes, swamps, and barrier islands by the year 2050. The loss of wetlands could result in ecosystem conversion to open water by placing the following ecosystem functions at risk:

- Vegetative habitat suitability and community diversity;

- Elevational maintenance and soil contribution from decomposing organic material;
- Protection against substrate erosion;
- Water quality improvement;
- Nutrient uptake and carbon sequestration;
- Important nursery habitat;
- North American Central Flyway and North American Mississippi Flyway waterfowl;
- Wintering habitat; and
- Resting and feeding areas for neotropical migrants.

LCA ARDC Study Area. The primary problem within the LCA ARDC study area is ecosystem degradation of the freshwater swamps adjacent to the ARDC. The natural hydrology within the study area has been modified by construction of the ARDC (1964) and construction of the railroad grade utilized during the 1800s through the early 1900s to aid with lumber extraction activities (see Figure 1.3 with location of railroad grade). These features have resulted in impoundment of the swamp. Sea level rise (Gornitz *et al.,* 1982) and geological subsidence have compounded the effects of these modifications. The modification of the hydrology within the study area has led to hydrologic isolation; impoundment of water, including storm surge-related, higher salinity waters; and lack of freshwater, sediment and nutrient inputs, all of which have contributed to the degradation and conversion of the freshwater swamps to marsh and open water habitats. Impoundment leads to a reduction in freshwater, sediment and nutrient input within the study area.

2.3.3.1 Modification of Natural Hydrology

The construction of flood control projects within the LCA ARDC study area, primarily the ARDC component of the Amite River and Tributaries (AR&T) project, together with other land use practices, such as land development and logging, have significantly altered the hydrology of the study area. These projects and practices have altered patterns of water and sediment flow through the bald cypress-tupelo swamp, directly converting swamps to marsh and open water and indirectly altering the natural processes instrumental in the development and sustenance of a healthy coastal swamp ecosystem.

2.3.3.2 Subsidence

Land elevations decrease from subsidence, which may be produced by compaction, oxidation, and consolidation of sediments, faulting, groundwater depletion, or decreased organic deposition as a result of decreased vegetation biomass production. Within a healthy freshwater swamp, land elevations have the potential to increase as a result of sediment accretion, from direct sediment input

from riverine sources or from organic vegetation deposition. The soil characteristics of the western Maurepas Swamp indicate a lack of riverine influence as evidenced by high soil organic matter content and low bulk density values (DeLaune *et al.*, 1979; Hatton, 1981; Messina and Conner, 1998). Consequently, soil building within the Maurepas Swamp is almost exclusively a result of organic productivity (Shaffer *et al.,* 2001, 2003, 2006 and 2009). In the swamps adjacent to the ARDC, productivity is substantially depressed compared to normal conditions (Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force, 2002). Subsidence in the LCA ARDC study area and vicinity is classified as intermediate, at about 1.1-2.0 feet per century (LCA, 2004). With minimal soil building and intermediate subsidence, there has been a net lowering of ground surface elevation, doubling flood frequency over the last four decades (Thompson, 2000), so that the swamps are now persistently flooded.

2.3.3.3 Sea Level Rise

2.3.3.3.1 Eustatic Sea Level Rise. Eustatic sea level rise is the global change in the oceanic water level. Eustatic sea level rise has been attributed to the global increase in ocean volume and has been estimated as 1.0-2.4 millimeters per year (mm/yr) (Church *et al.*, 2001). Long-term sea level rises are projected to increase due to global climate change (Titus and Richman, 2001).

2.3.3.3.2 Relative Sea Level Rise. Relative sea level rise refers to the difference between the change in eustatic sea level and the change in land elevation. The combination of subsidence and eustatic sea level rise would likely cause the landward movement of marine conditions into estuaries, coastal wetlands and fringing uplands (Day and Templet, 1989). Relative sea level rise has been measured in the Mississippi Delta at rates as high as 10 mm/yr (Snedden *et al.*, 2007).

Based on guidance in USACE EC-1165-2-211, it was determined that a low estimate for relative sea level rise over for the 50-year period of analysis (2061) is 1.5 ft (0.46 m); an intermediate estimate is 1.9 ft (0.58 m); and a high estimate is 3.2 ft (0.97 m). Sediment and organic accretion will not likely mitigate RSLR, especially with no action. Under the FWOP condition little to no biomass accretion would occur due to the continued degradation within the study area and the lack of hydrologic connectivity. It has been estimated that biomass accretion levels for a healthy freshwater swamp within the study area would be approximately 8 mm/yr (Bernard Wood, unpublished data, 2005 through 2009).

2.3.3.4 Tropical Cyclone Events

Tropical cyclone events exert a stochastic but severe influence on the LCA ARDC study area. Tropical cyclone events can directly and indirectly contribute to

coastal land loss through a variety of processes, including erosion from increased wave energies, removal and/or scouring of vegetation from storm surges, and saltwater intrusion into estuaries and interior wetlands carried by storm surges. These destructive processes can result in the loss and degradation of large areas of coastal habitats in a relatively short period of time (e.g., days and weeks versus years). These saltwater surges become impounded for long periods of time in the areas of impact along the ARDC, causing additional damage to the soils and vegetation.

The storm centers of at least 15 tropical cyclones with a Saffir-Simpson Hurricane Scale of Category 2 or higher have passed within 50 miles of the LCA ARDC study area during the interval 1851-2008, and at least 52 such tropical cyclones have passed within 100 miles of the study area during the same interval (National Oceanic and Atmospheric Association (NOAA) Coastal Services Center, 2009). The most recent tropical cyclones affecting the study area were hurricanes Katrina (August 2005), Rita (September 2005) and Gustav and Ike (September 2008).

Hurricanes Katrina, Rita, Gustav, and Ike – These tropical storms did not have a significant direct impact on the study area; there was very little wind and wave damage as noted by subsequent field investigations. These, and other storms, did have an indirect effect due to the introduction of higher-salinity storm surge waters into the impounded swamps within the LCA ARDC study area. This salt intrusion, particularly in the impounded areas, reduces biomass production and impairs health, which in turn increases tree mortality, decreases soil production and integrity, and consequently increases relative subsidence (CWPPRA Task Force, 2002). These higher-salinity storm surge waters become impounded in the swamp by the dredged material berms along the ARDC and are not drained from the swamps during seasonal low flow events or flushed by seasonal river bank overflow events. Consequently, these periodic influxes of saline storm surge waters cumulatively increase salinity in impounded waters and soils in the study area. Even though salinity spikes are inevitable, increased connectivity through the ARDC dredged material berms would allow the large headwater event that normally follows a tropical storm to flush the higher salinity waters out of the swamp before it has an opportunity to infiltrate into the substrate. This flushing action could greatly reduce the impact of salinity spike generated by tropical storm events.

2.3.4 Effects

A direct result of the problems impacting the study area include the impoundment of water within the swamp areas, reduced amounts of natural hydrologic connectivity which leads to limited amounts of sediment and nutrient transport to

the swamp habitat, and the eventual degradation of existing habitat. The following section describes each of these effects.

2.3.4.1 Impoundment

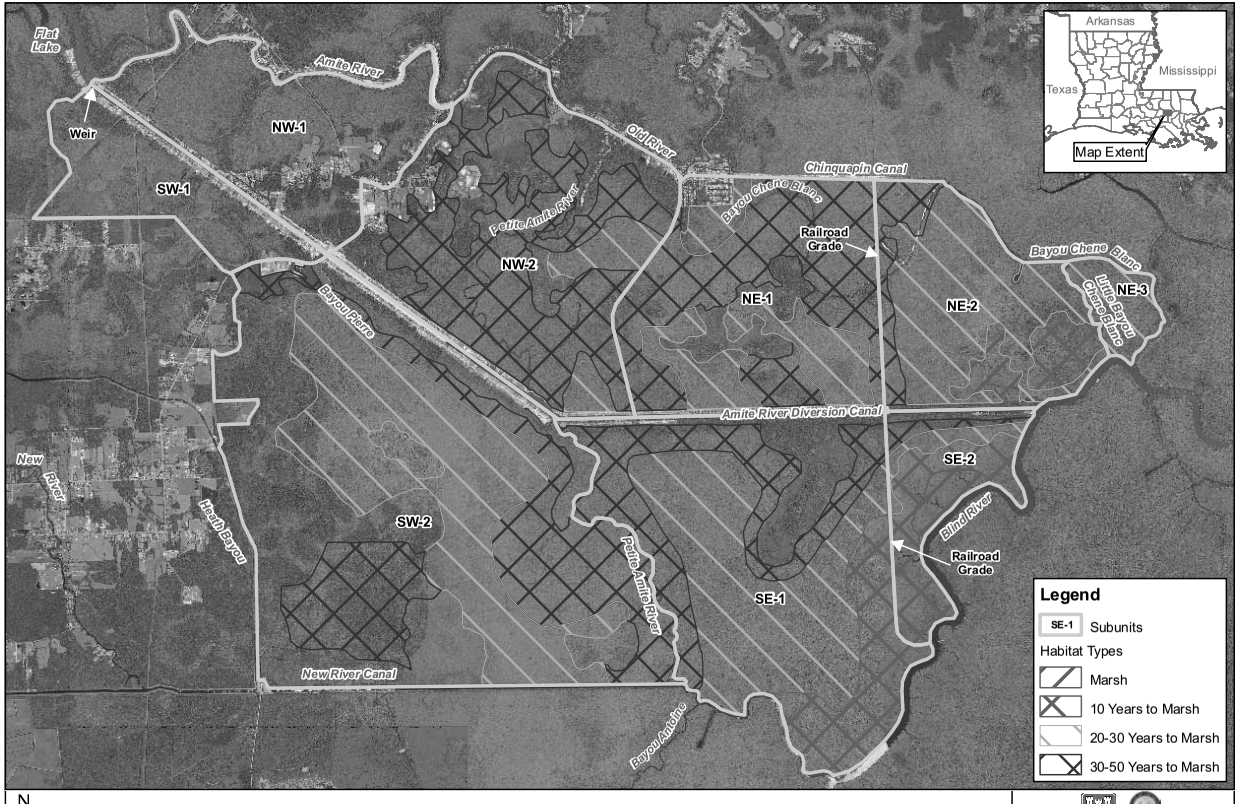
The placement of dredged material as berms along either side of the ARDC disrupted sheet flow within the LCA ARDC study area and formed topographic high points (ridges) that prevented the drainage of bald cypress-tupelo swamps into the ARDC during low surface flow intervals (USACE, 2004). This activity, in conjunction with other activities, such as the construction of a railroad grade utilized for logging that traverses the eastern study area from north to south, permanently impounded bald cypress-tupelo swamp habitat within the study area.

Impoundment within the study area has also contributed to decreased water quality and increased cypress and tupelo seedling mortality, which in turn have contributed to increased habitat conversion to marsh and open water. Additional damages to vegetative resources and soils have occurred when saltwater storm surges are impounded within the system over long periods; vegetation becomes stressed and additional salt leaches into the soil substrate. Increased connectivity through the ARDC dredged material berms would decrease impoundment and allow a large headwater event to flush the higher salinity waters out of the swamp before it has an opportunity to infiltrate into the substrate. This flushing action could greatly reduce the impact of salinity spike generated by tropical storm events.

Swamp impoundment is particularly pronounced in the eastern portion of the LCA ARDC study area (subunits NE-1 and NE-2), as demonstrated by 2005 hydrograph data from the CWPPRA Priority Project List (PPL) 16 proposal *Hydrologic Restoration in the Swamps West of Lake Maurepas,* Figure 2.2, and Table 2.2.

Table 2.2. Conversion of Habitat Types (Years to Marsh)

Years to Marsh	Acres
Existing Marsh	300
10 Years to Marsh	1,723
20 – 30 Years to Marsh	7,979
30 – 50 Years to Marsh	8,202
Total	**18,204**



HABITAT TYPES

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Source: Bernard Wood, personal communication, October 2009
Image: 2009 Livingston Parish and Ascension Parish USDA-FSA-APFO NAIP MrSID Mosaics

Figure: 2.2
Date: February 2010
Scale: 1:75,000
Source: USGS/GEC
Map ID: 27850108-1890

The habitat types shown in Figure 2.2 represent areas of degradation expected to occur within the study area over the 50-year period of analysis, based on field observations and professional judgment provided by Dr. Gary Shaffer. More specifically, Table 2.2 quantifies acreages associated with each habitat type found in Figure 2.2. The figure includes four habitat types, consisting of existing marsh, 10-years to convert to marsh, 20-30 years to convert to marsh, and 30-50 years to convert to marsh.

Marsh. This represents areas within the study area that have converted to freshwater marsh habitat and are in transition to open water. These areas are characterized by non-existent canopy and scrub-shrub and herbaceous type vegetation. These areas are considered the most degraded within the study area.

10-years to Marsh. This represents areas within the study area likely to transition into marsh with the next ten years. These areas are characterized by little-to-no canopy cover, which is indicative of areas in which degradation is taking place and the habitat is nearing conversion to freshwater marsh. This habitat type is located in areas with hydrologic connectivity, but lack freshwater flushing and is subsequently subject to increased saltwater intrusion.

20-30 years to Marsh. This represents areas within the study area likely to transition into marsh with the next 20-30 years. These areas are characterized by reduced canopy cover, which is indicative of areas in which freshwater swamp tree species are present, but exhibit reduced stand productivity. This habitat type exhibits reduced hydrologic connectivity, is found in impounded areas that lack freshwater flushing, and is subject to saltwater intrusion during high-water events.

30-50 years to Marsh. This represents areas within the study area likely to transition into marsh with the next 30-50 years. These areas are characterized by the beginning stages of canopy cover reduction, and are indicative of areas in which freshwater swamp tree species are abundant, but exhibit reduced stand productivity. This habitat type has little-to-no hydrologic connectivity, is found within impounded areas that lack freshwater flushing, and is often not influenced by saltwater intrusion.

Approximately 11 months of water gage data were recorded in the eastern portion of the study area from three water gages within the ARDC and inundated swamp habitat on the left descending bank. These data indicate the swamp habitat along the left descending bank of the ARDC in the eastern portion of the study area is impounded; water levels within this area never receded below 2.2 feet above mean sea level (msl), although canal water levels receded below that level (Shaffer *et al.,* 2006). Areas within Figure 2.2, which do not display a time frame for degradation, indicate that no degradation will occur for these areas within the 50-year period of analysis.

2.3.4.2 Decreased Connectivity Resulting In Decreased Freshwater, Sediment, and Nutrient Inputs into the Swamps

Historically, hydrologic conditions within the LCA ARDC study area were influenced by the Amite River in the north and west, by overbank flow from the Mississippi River in the south, and by tidal influence from Lake Maurepas in the east (Hamilton and Shaffer, 2001; CWPPRA Task Force, 2002). Periodic flooding of the Amite and/or Mississippi Rivers inundated bald cypress-tupelo swamps within the study area. Flooding occurred in and near the study area, with peak water elevations in the late spring or early summer. As floodwaters receded, surface waters in the study area were conveyed eastward via sheet flow to Bayou Chene Blanc or Blind River and, then to Lake Maurepas. Flood control implementation such as construction of the ARDC, disrupted the natural hydrologic regime within the LCA ARDC study area. River channelization and levee construction greatly reduced overbank flooding in the study area, nutrients and sediments in the ecosystem were lost, and water quality was decreased (CWPPRA Task Force, 2002).

The swamp within the LCA ARDC study area is severely nutrient-limited (Shaffer *et al.,* 2001). However, biomass production of herbaceous vegetation has been significantly enhanced (approximately 33 percent) by nutrient augmentation based on data from monitoring stations located within the western Maurepas Swamp outside of the study area.

Decreased water quality and increased salinity have also contributed to swamp ecosystem degradation in the LCA ARDC study area. A water quality analysis of surface waters in the western Maurepas Swamp was conducted in support of CWPPRA Project PO-29 *Mississippi River Reintroduction into Maurepas Swamp* (Day *et al.,* 2001). Nitrate, ammonium, and nitrogen concentrations at surface water stations in the western Maurepas Swamp were lower than Mississippi River concentrations. As a result, the bald cypress-tupelo swamp in the study area and vicinity is severely nutrient-limited. The trees are also highly stressed from elevated salinities, which decrease productivity and increase mortality and susceptibility to herbivory and parasites (CWPPRA Task Force, 2002).

Saltwater intrusion has increased in this general area, partly due to net subsidence and the lack of riverine freshwater inputs. Salinities as low as three parts per thousand (ppt) can reduce growth of both bald cypress and water tupelo saplings (Pezeshki, 1990). Salinity, combined with flooding stress, can substantially reduce bald cypress growth. Consequently, salinity significantly contributes to swamp deterioration, particularly combined with stressors such as flooding and herbivory.

Storm surges from Lake Maurepas caused by tropical cyclones also exert a stochastic but severe stress on the swamp habitat through salinity spikes in swamp surface waters. Dredged material berms prevent higher salinity water from being flushed out of the system (CWPPRA Task Force, 2002). Storm surge waters remain in the impounded swamps of the LCA ARDC study area cumulatively increasing salinities in impounded waters and soils.

2.3.4.3 Habitat Changes and Land Loss

Decreased Productivity. Vegetative communities in the LCA ARDC study area have decreased productivity according to previous reports and studies (Hoeppner *et al.,* 2007). The existing levels of productivity in the western Maurepas Swamp are as low as 25 to 50 percent of average values found within swamps that are managed or have more favorable hydrology, and/or receive nutrient enrichment (Hamilton and Shaffer, 2001).

From 2000-2007, diameter growth measurements for more than 1,800 trees in the western Maurepas Swamp were significantly less than established growth levels for trees in healthy freshwater swamp systems (Shaffer *et al.*, 2008). In interior swamp locations, such as the LCA ARDC study area, the primary factors inhibiting diameter growth were nutrient-poor stagnant standing water and the lack of nutrient-rich freshwater exchange caused by the loss of hydrologic connectivity with riverine systems.

Increased Seedling Mortality. Seedling germination and establishment are essential to ensure sustainability of bald cypress-tupelo swamp by replacing trees lost to disease and other causes. However, the establishment of bald cypress and tupelo seedlings is impaired in the LCA ARDC study area due to persistent flooding from impoundment (CWPPRA Task Force, 2002). Bald cypress and tupelo seeds cannot germinate when flooded (Hamilton and Shaffer, 2001). Seeds of both species remain viable when submerged in water and can germinate readily when floodwaters recede (Kozlowski, 1984). However, the seedlings require seasonal drying periods, and the substrate compaction associated with these drying periods, for root systems to become properly established in the swamp substrate. With minimal ability to drain and persistent flooding, the typical seasonal drying of the LCA ARDC swamp does not usually occur and seedlings fail to establish themselves and replace older trees lost to other natural processes (CWPPRA Task Force, 2002).

Nutria, which are common to the study area, pose a threat to seedling establishment, and could result in increased mortality of planted and regenerated freshwater swamp vegetation.

Increased Habitat Conversion. As shown in Section 5.6.2 most of the Maurepas Swamp is stressed and appears to be on a trajectory of slow degradation leading to a gradual conversion to marsh and open water (Hoeppner *et al.,* 2007). Stagnant flooding and nutrient deprivation appear to be the largest stressors in the swamp interior, whereas increased salinity, flooding stress, and nutrient deprivation are killing many trees along the navigable waterways, such as the ARDC and Blind River.

Under the continued influence of these conditions, tree mortality would continue to increase and tree density would continue to decline. Based on the low tree density, degraded condition, and expectation for mortality, the USACE estimated that most swamp habitat within the LCA ARDC study area would degrade to less than 33 percent canopy cover within 20 years (USACE, 2004). Approximately 46 percent of the canopy within the study area would remain within 20 to 30 years; this is comparable to USACE data (Figure 2.3) (Shaffer *et al.,* 2009). Because of this degradation and decreased productivity, soil accretion is insufficient to offset regional subsidence, and the degraded swamp habitat is consequently susceptible to conversion to fresh marsh (Hamilton and Shaffer, 2001). Land area trends in the study area for the interval 1985-2006 were calculated by the U.S. Geological Survey (USGS) using Landsat Thematic Mapper (TM) analysis (Barras *et al.*, 2008). Land area trends within the study area were relatively stable with an average land loss of less than two acres per year. However, Landsat TM imagery does not distinguish between forested canopy and marsh vegetation. Other studies indicate that land area trends for bald cypress-tupelo swamp in the study area are unstable and habitat conversion is occurring at an accelerated rate in portions of the study area (USGS, 2008).

Bald cypress-tupelo swamp is already converting to freshwater marsh in the LCA ARDC study area particularly north of the ARDC in the eastern study area in subunits NE-2 and SE-2 (CWPPRA Task Force, 2002). Many fresh marsh areas in the greater southern Maurepas Swamp have converted to fragile spikerush flotant. Approximately 9,702 acres of swamp habitat would fully convert to marsh habitat within 20 to 30 years (Figure 2.2 and Table 2.2). Throughout this report the habitat surrounding the ARDC is referred to as freshwater or bald cypress-tupelo swamp. While it is recognized that portions of the study area have converted to freshwater marsh, it is generally referred to as a freshwater swamp habitat.

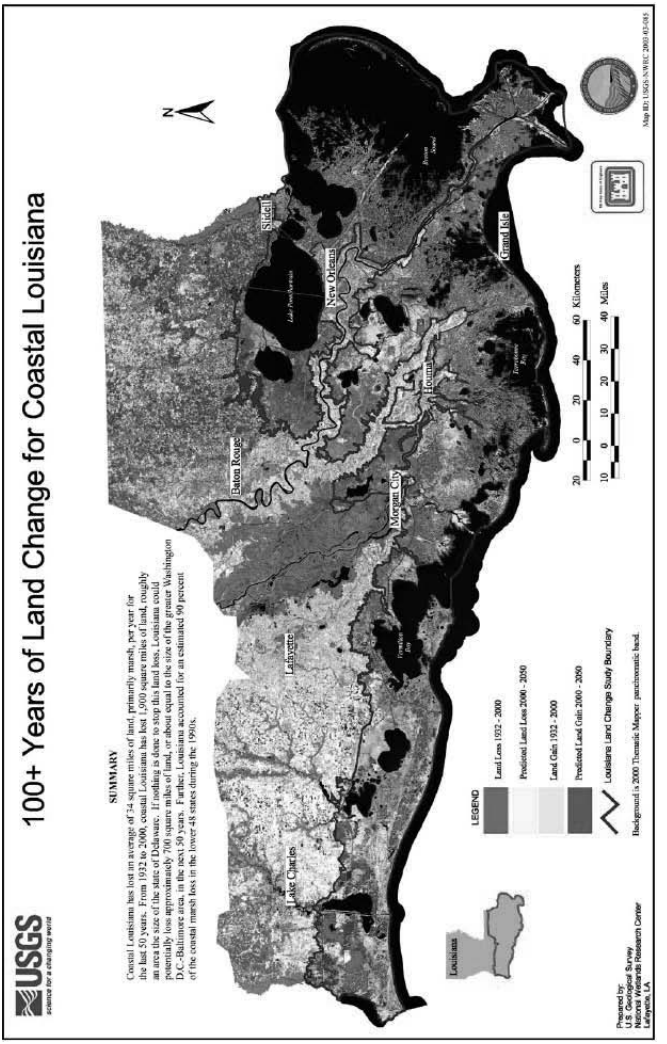


Figure 2.3. Predicted Land Change for Coastal Louisiana (USACE, 2004)

Without restoration, factors and processes contributing to stress and deterioration of swamps near the ARDC would continue and result in swamp habitat loss with succession to open water. The wetland loss rates developed by Coast 2050 for the Amite/Blind Rivers mapping unit (which contains the LCA ARDC study area) for 1974-1990 were estimated to be 0.83 percent per year for swamp habitat, and 0.02 percent per year for fresh marsh (CWPPRA Task Force, 2002). Based on these rates, approximately 35 percent (18,204 acres) of the bald cypress-tupelo swamp within the study area would be converted to fresh marsh or open water for the interval 2012-2062.

2.3.4.4 Increased Invasive Species

The spread of invasive species decreases native plant communities, altering ecosystem function. Within the LCA ARDC study area, water hyacinth, alligator weed, hydrilla, common salvinia, giant salvinia, and variable-leaf milfoil are invasive aquatic vegetative species, which displace native aquatics and degrading water and habitat quality [Louisiana Coastal Protection and Restoration (LACPR), 2009]. Additionally, the study area has the Chinese tallowtree which is tolerant to flooding and salt stress and can establish self-replacing monocultures that provide less foraging value to migrating birds and interrupt the natural succession of woody species (LACPR, 2009). It should be noted that disturbed ecosystems are more vulnerable to invasive species than stable ecosystems; therefore, invasive species are a severe threat to biodiversity and ecological function in the study area. An additional invasive species found throughout the study area are nutria. This species of wildlife impacts the vegetative resources by increasing seedling mortality and reducing natural regeneration.

2.3.5 Needs

According to the 2004 LCA report, critical needs for restoration of coastal Louisiana include:

Prevent future land loss where predicted to occur: Addressing this need would create and sustain diverse coastal habitats, sustain wildlife and plant diversity, and sustain socio-economic resources. Effective measures to reverse coastal land loss should affect plant communities, in their root zone, in such a way as to promote healthy growth and reproduction, plant succession, or revegetation of denuded surfaces. Increasing nutrients and sediment in the estuarine area would increase the growth of marsh vegetation and slow the rate of land loss. Increased plant growth would result in greater production of organic detritus that is essential for a high rate of fisheries and wildlife production. Production of phytoplankton and zooplankton would increase in areas where turbidity is not limiting, and, as a result, the harvest of sport and commercial finfish and shellfish that depend on these microorganisms would increase.

Restore fundamentally impaired or mimic deltaic processes through river reintroductions: Addressing this need would reduce habitat deterioration by increasing nutrients and sediment delivered to the estuarine-marsh areas, which would increase marsh vegetation sustainability and improve fish and wildlife production. In addition, restoring riverine influences to coastal wetlands and creating wetlands would help address the need to reduce the nutrient loading into the northern gulf and to reduce the hypoxic zone. This need can be met by restoring or mimicking distributary flows, crevasses, and over-bank flow, as well as mechanical marsh creation with river sediment, if sustained by freshwater reintroductions.

Restore or preserve endangered critical geomorphic structures: Addressing this need would restore geomorphic structures, such as natural levee ridges, lake rims, land bridges, gulf shoreline barrier islands, barrier headlands, and chenier ridges. These features are essential to maintaining the integrity of coastal ecosystems because they are an integral part of the overall system and in many instances represent the first line of defense against marine influences and tropical storm events.

Protect vital local, regional, and national socioeconomic resources: Addressing this need would reduce the increased risk of damage to cultures, communities, infrastructure, business and industry, and flood protection. Accelerated land loss and ecosystem degradation places over $100 billion of infrastructure at increased risk to damage as a result of storm events. This need could be met by increasing the marsh's capacity to buffer hurricane-induced flooding through wetland creation, and sustenance and retention of barrier island systems.

The critical needs for the LCA ARDC Modification project study area were developed based on those included in the 2004 LCA report and include the following:

Prevent future conversion of freshwater swamp habitat to freshwater marsh and ultimately open water: Addressing this need would help to reverse the trend of land degradation occurring within the LCA ARDC study area and contribute to maintaining critical habitat for numerous species of vegetation, fish, and wildlife species native to freshwater swamp habitats. The habitat degradation occurring within the study area is previously depicted in Figure 2.2.

Restore the natural processes necessary for a functioning and healthy freshwater swamp habitat: Addressing this need would preserve and improve the functions provided by bald cypress-tupelo swamp habitat, vital to numerous wildlife and vegetative species. Functions would include natural

hydrologic cycles, hurricane protection, and improved water quality. Restoring these functions increases the likelihood of producing a sustainable ecosystem.

Preserve and protect local socioeconomic resources: Addressing this need would prevent the loss of socioeconomic resources available within the LCA ARDC study area, resulting from continued habitat degradation and land loss. This includes the reduction in storm surge and hurricane winds provided by a healthy freshwater swamp, and improved water quality.

2.3.5.1 Future Without Project Condition

Without Federal action, the swamp habitat surrounding the ARDC would continue to degrade resulting in the eventual conversion from a freshwater swamp to a freshwater marsh and open water. The FWOP condition would be the continued impoundment of swamp water within the study area, a reduction in tree canopy, water quality, hydrologic connectivity, and a transition towards marsh and salinity-tolerant vegetation. Storm surges from tropical cyclone events would increase salinity levels, and the frequency of saltwater inundation is expected to increase with Relative Sea Level Rise (RSLR). The FWOP is the basis to compare the alternatives in Plan Formulation (Section 3).

It is anticipated that the swamp will continue to convert to fresh marsh and eventually to open water (Figure 2.2). The lack of exchange of freshwater, sediments, and nutrients will continue to lead to reduced tree vigor and growth, increased tree mortality, increased invasive species stands, and loss of ecological functions. Likely, with the expected RSLR rise, the swamp degradation would accelerate in the future. Major portions of subunits NE-2, SE-2, and SE-1, would likely deteriorate to fresh marsh within 30 years (Figure 2.2), some areas have already converted to fresh marsh. Additionally, the fresh marsh habitat will convert to open water and additional wetland functions will be lost. The effects of the FWOP on each resource are presented in Table 5.1.

Functions lost include habitat for wildlife and aquatic species, recreational opportunities, aesthetics, and storm surge protection. The freshwater marsh does offer some of the functions of the freshwater swamp, but certain functions are lost, such as habitat for avian species and some storm surge protection. Based on the findings of the 2004 LCA report, preserving and protecting freshwater swamp habitat is of national significance.

Analysis has shown that there has been some recovery for relic open areas in subunit SW-2. However, these relic open areas were not caused by the ARDC dredged material banks. All analyses and investigations to date have suggested that the ARDC dredged material berms have, and likely will continue, to cause degradation of the fresh water swamp habitat.

Indirect impacts resulting from the continued habitat degradation would be the continued decline of wildlife, fishery, and vegetative resources. Flora and fauna species could experience stress due to saline waters not being flushed from the system, and may change as salt-tolerant species replace fresh water species. Air quality would decline due to population growth in Livingston and Ascension Parishes and increased numbers of vehicles and further commercialization and industrialization. Existing swamp habitat would convert to water bottoms and alter the benthic community, and decrease available nutrients and detritus. The habitat quality would continue to degrade, thereby creating a stressful environment for species present. Continued degradation would result in loss of habitats for protected species that utilize the study area, including the West Indian manatee, and Gulf sturgeon. Degraded viewscapes for the study area would be a result of degradation. Coastal Louisiana's wetland loss and the depletion of wetland-dependent natural resources could result in a decline of job opportunities and personal income throughout rural coastal areas. Existing and future infrastructure present within the study area would be adversely affected. Maurepas Wildlife Management Area (WMA), is the only public lands located within a portion of the study area, would be affected. There would be increased exposure of existing oil, gas, and utility pipelines to coastal land loss, which would increase operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs, as well as increase the required investment in facilities and pipelines. Coastal forest habitat provides protection from tropical cyclone events; consequently, there could be an increase in storm surge and risk of flooding. Wetland loss would impact commercially important species, including black drum, brown and white shrimp, and blue crab, leading to declining abundances.

Cumulative impacts would be shoreline erosion and land loss resulting in a projected conversion of 18,204 acres of swamp soils to fresh marsh and open water. There would be decreased flows into and out of the swamp due to dredged material berms along the ARDC, increased water levels due to coastal wetland loss and increased runoff due to increased urbanization of the Pontchartrain Basin. The water and air treatment functions of wetlands would subside. The integrity of existing cultural, historical, and recreational resources, as well as aesthetics within the study area would be compromised. Infrastructure, public facilities, and businesses would be adversely impacted. Property values may decline as wetlands continue to degrade. Public lands would be adversely affected. Localized storm surge and storm wave damages are likely to increase. A loss of commercial fishery habitat is likely. Impacts on all forms of vegetation include continued deterioration, and loss of vegetation and wetland habitat acreage. Continued nationwide wetland loss would lead to increased acreage of shallow water bottoms. Benthic populations and plankton would respond to perturbations with a shift towards saline-oriented species as land loss and saltwater intrusion continue. Land loss within the study area would threaten the existence and integrity of cultural and historic resources. Loss of vegetation would degrade the visually complex environment and reduce

opportunities for viewing wildlife. The degradation and loss of wetlands would contribute to increased maintenance costs of infrastructure. Several of the current residential subdivisions within the study area may expand, creating additional roads, bridges and associated utilities. As populations continue to migrate to coastal communities, increasing investment in hurricane and flood control levees, pump stations, and other flood control facilities are likely to increase.

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time. This spill could potentially adversely impact USACE water resources projects and studies within the Louisiana coastal area. Potential impacts could include factors such as changes to existing or baseline conditions, as well as changes to future-without and future with project conditions. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact USACE water resources development projects/studies. Supplemental planning and environmental documentation may be required as information becomes available.

2.3.6 Opportunities

The 2004 LCA report listed opportunities for ecosystem restoration for coastal Louisiana as:

- Freshwater reintroductions and outfall management - Diverting water from the Mississippi River into hydrologic basins can (1) nourish existing marshes to increase their productivity and build wetlands in areas of open water, (2) potentially reduce the extent of the hypoxic zone in the gulf, (3) help satisfy the need for maintaining salinity gradients that correspond to the diversity of vegetative habitat, and (4) reintroduce and distribute sediment and nutrients throughout the ecosystem;

- Barrier island restoration, through placement of sand from offshore sources or the Mississippi River, could sustain these geomorphic structures, which would provide additional protection from hurricane storm surges and protect the ecology of estuarine bays and marshes by reducing gulf influences, as well as protect Nationally important water bird nesting areas;

- Hydrologic modification, such as degrading excavated dredged material banks or reestablishing ridges or natural banks, can help restore salinity and marsh inundation patterns and provide fishery access in previously unavailable habitats; and

- The use of sediment material from dedicated dredging or maintenance dredging (e.g., beneficial use) to create a marsh platform can create large amounts of coastal habitat quickly.

The 2004 LCA report emphasizes that many of the above techniques can be applied in combination to produce synergistic effects while minimizing disruptions to the surrounding ecology and economy (e.g., dedicated dredging in conjunction with a small river diversion to increase the sustainability of the created marsh).

Opportunities for the LCA ARDC Modification project have been identified to improve habitat conditions and address many of the problems identified in the study area. These opportunities were chosen based on the potential for ecosystem restoration that exists for portions of the study area and were used as the foundation of the Plan Formulation process.

Opportunities for ecosystem restoration within the LCA ARDC study area as described in the 2004 report are to:

- Improve the hydrologic processes impaired by dredged material berm construction, including connectivity, sheet flow, and freshwater nutrient inflow and outflow;
- Prevent future bald cypress swamp degradation and transition currently predicted to occur;
- Improve areas that have been degraded and transitioned to fresh marsh or open water; and
- Protect vital socioeconomic and public resources.

2.4 PLANNING OBJECTIVES

Study goals, objectives, and constraints were developed to comply with the study authority and to respond to study area problems and opportunities.

2.4.1 Goals

The goal of the LCA ARDC Modification project is to reverse the degradation trend within the western Maurepas Swamp ecosystem that has been adversely affected by the construction of the ARDC. The project would provide nutrients and sediment to facilitate organic deposition in the swamp, improve biological productivity, and prevent further swamp deterioration. According to the 2004 LCA Ecosystem Restoration report, the exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. The project maximizes the use of restoration strategies that reintroduce historic flows of river water, nutrients, and sediment to coastal wetlands, and that maintain the structural integrity of the coastal ecosystem. Execution of the LCA Plan would make significant progress

towards achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus, contribute to the economy and well-being of the Nation. Benefits to and effects on existing infrastructure, including navigation, hurricane protection, flood control, land transportation works, agricultural lands, and oil and gas production and distribution facilities were considered in the formulation of coastal restoration plans.

2.4.2 Objectives

The planning objectives identified in the 2004 LCA report include the following:

Hydrogeomorphic Objectives

1. Establish dynamic salinity gradients that reflect natural cycles of freshwater availability and marine forcing (fluctuation related to normal daily and seasonal tidal action or exchange).

2. Increase sediment input from sources outside estuarine basins, and manage existing sediment resources within estuarine basins, to sustain and rejuvenate existing wetlands and rebuild marsh substrate.

3. Maintain or establish natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function.

Ecosystem Objectives

1. Sustain productive and diverse fish and wildlife habitats.

2. Reduce nutrient delivery to the Continental shelf by routing Mississippi River waters through estuarine basins while minimizing potential adverse effects.

The project would provide nutrients and sediment to facilitate organic deposition in the swamp, improve biological productivity, and prevent further swamp deterioration.

The objectives identified in 2004 and further investigation of the problems and opportunities in the study area led to the establishment of the following planning objectives. In general, the objectives of the LCA ARDC Modification project are to introduce freshwater, nutrients and sediments into western Maurepas Swamp to reverse the current trend of deterioration.

Specific Project Objectives

1. Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.

2. Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.

3. Facilitate natural hydrologic cycle within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.

4. Improve fish and wildlife habitat within the study area over the 50-year period of analysis.

Performance measures and desired outcomes to determine project success in meeting these project objectives have been developed and are presented within the Adaptive Management and Monitoring Plan (Appendix I).

2.5 PLANNING CONSTRAINTS

Development and evaluation of restoration alternatives for the proposed project are constrained by a number of factors. Specific Planning Constraints identified for the LCA ARDC Modification project include the following:

Flood Control: The ARDC is a component of the AR&T (1956) flood control channel. Project plans must not significantly decrease the performance and original intent of the ARDC and the AR&T project.

Designated Scenic Rivers: Blind River, located on the perimeter of the study area, is a designated Scenic River. Designated Scenic Rivers are protected by a set of use restrictions including channelization, clearing and snagging, channel realignment, reservoir construction, and commercial cutting or harvesting of trees or timber in violation of the Louisiana Scenic Rivers Act. Such restrictions may affect the type of project features that could be constructed along the Blind River.

Hydroperiod: Water levels within the ARDC exhibit seasonal high channel flow and low channel flow intervals. The natural variability of the hydroperiod necessitates a project design that allows the project to function as intended under a variety of flow regimes, ensuring that the project both

introduces nutrients and sediments to the adjacent swamps during high channel flow events and allows draining of swamps for seedling establishment during low channel flow events.

Other items that were taken into consideration during plan development and plan selections include:

Drainage Infrastructure: Existing drainage infrastructure within or adjacent to the study area, such as culverts and canals, performs the vital function of conveying excess water out of the area during heavy rainfall or flood events. Formulating a project design that does not impair the capacity of the existing drainage system with additional waters would help to ensure that residential flooding is minimized in the area.

Recreation: Minimize disruption of existing recreational use of the area and ARDC vessel traffic to the extent practicable.

Existing Development: Existing development along portions of the ARDC dredge material berms. This existing development will be considered as implementation of a project in these areas would require the demolition and replacement of certain residential structures and recreational facilities.

Water Quality: Planning objectives of the proposed project include the periodic draining of the swamp during low-flow intervals in the channel and flushing the adjacent habitat during high-flow intervals. Previous studies have indicated that swamps may release phosphorus sequestered within their substrates when subjected to a freshwater reintroduction. The introduction of phosphorus and other constituents into the ARDC and the potential impacts to downstream water bodies are identified ecosystem constraints for the proposed action. Development of a project design that minimizes potential negative impacts to downstream water quality is recommended.

3.0 ALTERNATIVES

3.1 PLAN FORMULATION RATIONALE

3.1.1 Plan Rationale

The plan formulation process is iterative, comprehensive and includes a number of detailed evaluations of potential measures and combinations of restoration measures, and an iterative refinement process for alternative development. This section presents a streamlined overview of the plan formulation process for the LCA ARDC Modification project. Specifically, management measures are presented, screening criteria are discussed, and initial alternative plans are presented along with the screening process to obtain the final array of alternatives. The alternative plans identified through the plan formulation process are then evaluated, based on study area problems and opportunities, as well as study goals, objectives and constraints. As specified in ER 1105-2-100, four criteria were considered during alternative plan evaluation: completeness, effectiveness, efficiency, and acceptability. These criteria are described in Section 3.1.2 of this report. Additionally, ecosystem benefits, cost-effectiveness, and environmental impacts were considered to ensure that the Recommended Plan best meets the project objectives. This section also describes the Tentatively Selected Plan (TSP) as the confirmed Recommended Plan and its implementation requirements.

As part of plan formulation, a Value Engineering (VE) study was conducted to identify potential modifications of restoration measures and plan configurations that could improve the performance and cost-effectiveness of the preliminary measures. The results of the VE study for this project were fully considered and were used to refine the measures and alternatives being considered.

A Value Engineering (VE) Study Report was completed to summarize the events of the VE workshop conducted May 18-22, 2009 for the U.S. Army Corps of Engineers (USACE), New Orleans District, by Value Management Strategies, Inc (Appendix H). The subject of the study was a group of three Louisiana Coastal Area (LCA) ecological restoration projects of which the Amite River Diversion Canal (ARDC) Modification project was one.

The three alternatives that were considered for the ARDC Modification project were:

- Increase the size and number of gaps in the railroad ridge.
- Use railroad ridge as an oak tree habitat.
- Develop an alternative that maximizes the long-term fresh water content of Lake Maurepas as a potential buffer to a major salt water inflow event.

The key recommended strategy from the VE study decided upon with regard to the ARDC Modification project was to increase the size and number of gaps in the railroad ridge. This was applied to the project alternatives as appropriate and is included as a part of the Recommended Plan.

3.1.2 Plan Criteria

3.1.2.1 Completeness

Completeness is the extent that an alternative provides and accounts for all investments and actions required to ensure the planned output is achieved. These criteria may require that an alternative consider the relationship of the plan to other public and private plans if those plans affect the outcome of the project. Completeness also includes consideration of real estate issues, operations, maintenance, repair, replacement, and rehabilitation (OMRR&R), monitoring, and sponsorship factors. Adaptive management plans formulated to address project uncertainties also have to be considered.

3.1.2.2 Effectiveness

Effectiveness is defined as the degree to which the plan would achieve the planning objective. The plan must make a significant contribution to the problem or opportunity being addressed.

3.1.2.3 Efficiency

The project must be a cost-effective means of addressing the problem or opportunity. The plan outputs cannot be produced more cost-effectively by another institution or agency.

3.1.2.4 Acceptability

A plan must be acceptable to Federal, state, and local government in terms of applicable laws, regulation, and public policy. The project should have evidence of broad-based public support and be acceptable to the non-Federal cost sharing partner.

3.1.3 Environmental Operating Principles

In 2002, the U.S. Army Corps of Engineers (USACE) formalized a set of Environmental Operating Principles applicable to decision-making in all programs. The principles are consistent with National Environmental Policy Act (NEPA); the Army Strategy for the Environment; other environmental statutes, and the Water Resource Development Act (WRDA) that govern USACE activities. The

Environmental Operating Principles inform the plan formulation process and are integrated into all project management processes. Section 3.7.7 of this report provides information on the effectiveness of the Recommended Plan in meeting all Environmental Operating Principles. Alternatives were formulated for this project consistent with the Environmental Operating Principles.

The USACE Environmental Operating Principles are:

- Strive to achieve environmental sustainability, and recognize that an environment maintained in a healthy, diverse, and sustainable condition is necessary to support life;
- Recognize the interdependence of life and the physical environment, proactively consider environmental consequences of USACE programs and act accordingly in all appropriate circumstances;
- Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another;
- Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems;
- Seek ways and means to assess and mitigate cumulative impacts to the environment and bring systems approaches to the full life cycle of our processes and work;
- Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work; and
- Respect the views of individuals and groups interested in USACE activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the Nation's problems that also protect and enhance the environment.

3.2 MANAGEMENT MEASURES

A management measure is a feature (a structural element that requires construction or assembly on-site) or an activity (a nonstructural action) that can either constitute an alternative plan by itself or, alternately, can be combined with other management measures to form an alternative plan.

3.2.1 Development of Management Measures

Management measures were developed to address planning objectives, study area problems, and capitalize on study area opportunities. These management measures

were derived from a variety of sources including prior studies, the NEPA public scoping process, the VE study, academia, and through the expertise of the interagency project delivery team (PDT).

The management measures were screened based on project objectives, constraints, effectiveness, and practicality. A total of 105 management measures were developed to address study area problems and to capitalize on study area opportunities.

3.2.2 Description of Management Measures

The management measures developed and evaluated for the ARDC study area can be grouped into the following categories:

Freshwater Reintroduction Measures

- Bank Openings (BO): Discrete openings at various locations along the ARDC dredged material berms, the relict railroad grade, and the natural banks of other study area waterways within the component subunits of the study area were considered. These measures could contribute to establishing hydrologic connectivity by allowing seasonal drying, promoting water circulation to improve water quality, and introducing nutrients and sediment to swamps. Bank openings could include open cuts, culverts, or bridged gaps. The locations for these openings would be chosen based on natural topography within the study area and LIDAR photographs of the study area. The placement of the dredged material would create bottomland hardwood habitat as a means of combating the effects of sea level rise within the study area.

- Berm Degradation (BD): Degradation of the entire ARDC dredged material berm complex, dredged material berm degradation within the component subunits of the study area, and degradation of the relict railroad grade were all considered. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying, promoting water circulation to improve water quality, and introducing nutrients and sediment to swamps.

- Conveyance Channel (CC): Construction of conveyance channels in the component subunits of the study area to establish a hydrologic interface between the ARDC and interior swamp locations was considered. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying, promoting water circulation to improve water quality, and introducing nutrients and sediment to swamps. The placement of the dredged material to create bottomland hardwood habitat was also considered.

- Hydraulic Pump (PU): Installation of hydraulic pumps between the ARDC and interior swamp locations within each subunit was considered. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying, promoting water circulation to improve water quality, and introducing nutrients and sediment to swamps. Additionally, a ring levee could be utilized to help offset the effects of relative sea level rise.

- Siphon Installation (SI): Installation of siphons in the component subunits of the study area to establish hydrologic connectivity between the ARDC and interior swamp locations was considered. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying or promoting water circulation to improve water quality, and introducing nutrients and sediment to swamps.

- Weir Construction (WC): Construction of weirs along the ARDC dredged material berms at various locations within the component subunits of the study area was considered. These measures could contribute to establishing some hydrologic connectivity at specific water stages and introducing nutrients and sediment to swamps.

- Weir Rehabilitation (WR): Rehabilitation of the existing weir at French Settlement at the confluence of the ARDC and the Amite River was considered. This measure could reduce the flow down the ARDC, thereby promoting the draining of the swamp in specific areas where existing cuts are located and impoundment is reduced.

- Wastewater Reintroduction (WWR): The reintroduction of wastewater from local industries and campsites was considered as a means of adding nutrients to the swamp habitat. An increase in nutrients could be provided to the areas currently impounded and therefore cut off from any nutrient supply. The nutrients would increase the production of tree species within the interior swamp.

- Maximize Lake Maurepas Freshwater Content to Act as a Saltwater Buffer (MLM): Measures were considered which would increase the overall freshwater content within Lake Maurepas in order to reduce saltwater intrusion from within this area. A reduction in saltwater intrusion would result in lower salinity levels within the swamp habitat and could allow for more production and regeneration of native swamp tree species.

Channel Restoration Measures

- Shoal Removal (SR): Removal of shoals or sediment plugs from the mouths of Bayou Pierre, the lower Amite River, and the Blind River were considered.

These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying, promoting water circulation to improve water quality, and (in the case of Bayou Pierre) introducing nutrients and sediment to swamps.

- Clearing and Snagging (CS): Clearing and snagging of natural waterways was considered at various locations within the component subunits of the study area. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying and promoting water circulation to improve water quality.

- Channel Dredging (CD): Channel dredging of natural waterways at various locations within the component subunits of the study area was considered. These measures could contribute to establishing hydrologic connectivity, allowing seasonal drying and promoting water circulation to improve water quality.

Habitat Restoration Measures

- Non-Structural Vegetative Planting (VP): Vegetative planting to restore bald cypress-tupelo communities in degraded areas throughout the study area was considered. This measure could contribute to preventing habitat conversion and future land loss, increasing swamp vegetative productivity, and restoring and preserving wildlife habitat. Plantings would serve as a means of creating a seed source in the study area for future regeneration as well. Nutria, which inhabit the study area, would increase seedling mortality. Nutria guards would be installed to protect the vegetative plantings.

- Spray Dredging (SD): Spray dredging of degraded areas adjacent to the ARDC was considered. This measure is a form of marsh creation in which dredged material is broadcast within a specific area in order to create marsh habitat. This measure could contribute to preventing habitat conversion and future land loss and restoring and preserving wildlife habitat. This measure was also considered a means by which to combat the effects of sea level rise within the study area.

- Habitat Creation via Placement of Dredged Material (HC): The placement of dredged material as additional upland and bottomland hardwood habitat was considered. These areas could serve as refuge for some species of wildlife during high-water events while also providing areas to implement supplemental plantings of bottomland hardwood tree species.

- Dedicated Dredging (DD): Dedicated dredging of Lake Maurepas for beneficial use material in marsh creation was considered. Dedicated dredging

is a form of marsh creation in which the material is mechanically or hydraulically placed within a specified area in order to create marsh habitat. This measure could contribute to preventing habitat conversion and future land loss and restoring and preserving wildlife habitat. This measure was also considered a means by which to combat the effects of sea level rise within the study area.

3.2.3 Screening/Evaluation of Management Measures

All 105 measures were screened based upon many criteria including: project objectives and constraints, benefits gained, expected subunit degradation, effectiveness, adverse environmental impacts, and practicability. Measures were screened out if they did not partially achieve any project objectives or if there were more effective or efficient measures available. Even though each measure was evaluated against its ability to accomplish the project objectives, no measure was eliminated if a specific objective was not achieved. Consideration was given to those measures which failed to achieve any of the stated objectives, but could be combined with other measures to achieve the project objectives. The effectiveness of each measure was considered to ensure that the objectives would be adequately met. If a measure resulted in overall, negative environmental impacts it was screened out. The practicability of each measure was considered to ensure that each measure could be implemented with a feasible amount of effort. From the 105 measures considered, 14 were retained for further study. Some measures originally considered, such as the removal of the entire dredged material berm along the ARDC, were screened out prior to the final development of all 105 management measures. Conversely, upon further feedback from the PDT, some measures were introduced after the initial group of measures was developed, such as the clearing and snagging of existing channels and bayous. Through this iterative process, the final 105 management measures were developed.

The screening strategy also included the evaluation of the study areas hydrologic subunits (Table 3.1) to determine subunits with the most near-term degradation, in keeping with the overall LCA goals to first address near-term degradation. The resultant subunits and management measures were further evaluated based on aerial photography, additional information, and field investigations. Of the nine subunits, four were retained for further study and evaluation.

Aerial photography indicated the general health or historical decline of some of the subunits within the study area. Most degradation could be linked with impoundment or a lack of hydrologic connectivity. However, for subunit SW-2 breaks in the canopy were identified in some of the earlier photographs, before construction of the ARDC. In order to account for these openings, additional analysis of the aerial photographs was conducted as stated in Table 3.1.

Table 3.1. Evaluation of Hydrologic Subunits

Hydrologic Subunit	Description	Reason Eliminated
NW-1	This subunit is connected hydrologically by Bayou Pierre and the Amite River. This area also contains an extensive housing development. Aerial photography and field investigation indicated that there was little degradation and thus little to no opportunity for restoration.	Eliminated because hydrologic connectivity with Bayou Pierre and Amite River already exist within this area. No restorative actions are warranted, therefore this subunit was eliminated
NW-2	This subunit contains the healthiest portion of the western Maurepas Swamp. Aerial photography and field investigation indicated that there was little opportunity for restoration.	This subunit provides a comparison for other degraded areas due to its healthy state. No restorative actions are warranted, therefore this subunit was eliminated.
NE-1	**This subunit is in need of restoration and there is an opportunity for restoration.**	**This subunit was found to be a degraded area, therefore this subunit was retained.**
NE-2	**This subunit has a high degree of habitat degradation and there is an opportunity for restoration.**	**This subunit was found to be a highly degraded area, therefore this subunit was retained.**
NE-3	This subunit has a degree of habitat change; however, no hydrologic measures were identified that would benefit the area. Aerial photography and field investigation indicated that there was little opportunity for restoration.	Due to a lack of impoundment, no hydrologic or restorative measures were identified that would benefit the area. Therefore this subunit was eliminated.
SW-1	This subunit is in good health and contains a series of culverts that provide hydrologic connectivity between the swamp and the ARDC. Aerial photography and field investigation indicated that there was little opportunity for restoration.	Due to existing hydrologic connectivity between the swamp and ARDC there are no measures that could benefit this subunit. Therefore this subunit was eliminated.

Hydrologic Subunit	Description	Reason Eliminated
SW-2	This subunit does not appear to need restoration. Initial review of aerial photographs suggested that degradation may be occurring due to the presence of some open water areas. However, a more detailed review of historic aerial photographs dating to 1940, before the construction of the ARDC, indicated that these openings historically existed (Figures 3.1-3.3). The aerial review indicated that the canopy in these open areas are developing a more closed canopy, suggesting recovery is already underway. Louisiana Department of Wildlife and Fisheries personnel recommended not dredging the bayous off the Petite Amite River on the WMA to drain ponds because standing water is beneficial to wildlife during droughts. During droughts, these open areas provide refugia for many aquatic and semi-aquatic species as well as drinking water for terrestrial wildlife. The open areas appear to be a natural feature of the landscape and not a human-induced phenomenon, and does not need restoration.	Based on a review of historic aerial photography, no apparent habitat degradation has occurred in this subunit due to construction of the ARDC. Therefore, no restorative actions are warranted and the subunit was eliminated.
SE-1	**This subunit has degraded areas, although not as degraded as NE-1 and NE-2. There are opportunities to restore and reduce degradation by increasing freshwater, sediment, and nutrient exchange.**	**There are opportunities to restore and improve this subunit by increasing connectivity to the ARDC, therefore it was retained.**
SE-2	**This subunit has degradation associated with stagnation and saltwater intrusion. There are opportunities to increase connectivity with the ARDC to increase connectivity and flush higher salinity waters after tropical storm events. Although the swamps of SE-2 are hydrologically connected to Blind River, this area needs fresh water, nutrients, and sediments, including the flushing of high saltwater intrusion events.**	**Sediment, water, and nutrient connectivity and inflow from the ARDC would benefit this area, including the flushing of saltwater intrusion after tropical storm events. While connectivity with Blind River does exist within the southern portions of this subunit, overall hydrologic connectivity between the ARDC and the northern portions of this subunit would provide additional nutrients and flush saltwater intrusion introduced by high-water events via Blind River. Therefore, this subunit was retained.**

As part of an initial screening process, the nine hydrologic subunits (NW-1, NW-2, NE-1, NE-2, NE-3, SW-1, SW-2, SE-1, SE-2) were examined to determine the degree of degradation, level of existing hydrologic connectivity, and identification of hydrologic measures that would benefit the area, and subunits NE-1, NE-2, SE-1 and SE-2 were retained for further study (Table 3.1). The most near-term degradation is expected to occur in the easternmost subunits and the opportunity to restore habitat is the greatest in these four subunits. Although there is some degradation in NE-3, it is not caused by the ARDC or other man-made sources. There does not appear to be an opportunity for restoration in NE-3. The westernmost subunits, NW-1 and SW-1 appear to be healthy and no restoration is needed. NW-2 is overall a very healthy system, mainly due to the connectivity with the Petite Amite River. SW-2 is a mostly healthy system with some areas expected to become marsh within 20-30 years. Public comments initially indicated that degradation had occurred within subunit SW-2. However, based on analysis of aerial photography and discussions with the Louisiana Department of Wildlife and Fisheries, it was determined that any perceived degradation existed within the subunit before construction of the ARDC (Figures 3.1 through 3.3). This analysis also showed that portions of SW-2 improved from 1940 to 2005. Therefore, it was concluded that subunit SW-2 was not degraded due to the construction of the ARDC or any problems stipulated in Section 2.3 of this report.

As a result of the initial screening process, several of the hydrologic subunits were determined to be healthy freshwater swamp habitat, with little to no habitat degradation. This emphasized a lack of near-term ecosystem restoration opportunities for these areas and deemphasized a need for immediate restoration action. However, this does not imply that other restoration actions would not be warranted, but that any other restoration effort would be beyond the scope of this project. The long-term preservation of these areas through acquisition by the state of Louisiana or a private land trust would help to maintain healthy habitat within these areas.

After evaluating each hydrologic subunit, the measures were screened based on project objectives, constraints, effectiveness, impacts, and practicability (Table 3.2). The measures carried forward for further evaluation were assembled into alternative plans designed to address study goals and objectives. All management measures considered were deemed consistent with Administration budget policy, specific USACE policies for ecosystem restoration, and Federal laws, regulations, and Executive Orders.

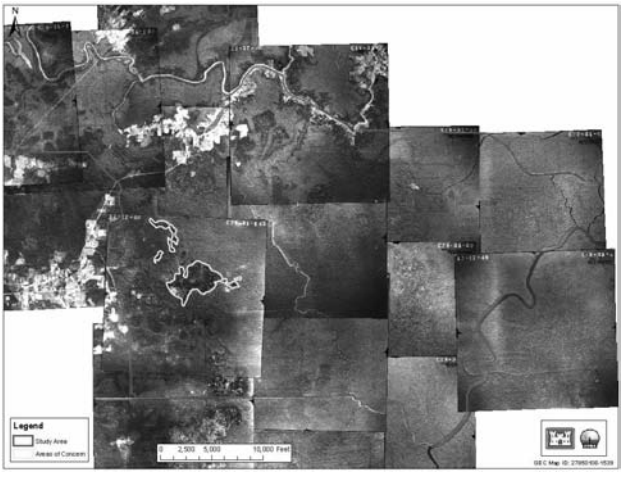


Figure 3.1. 1940 Aerial Photography with Area of Impact Outlined

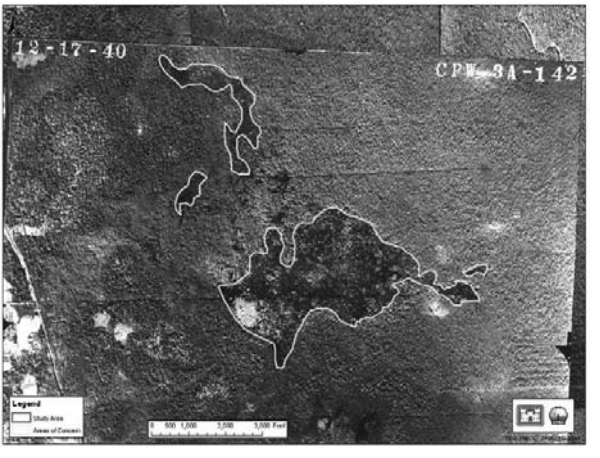


Figure 3.2. 1940 Aerial Photography -- Close-Up of Area of Interest

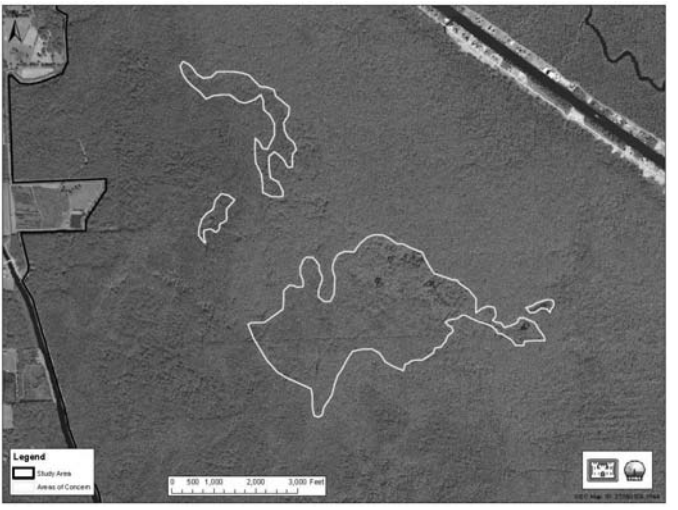


Figure 3.3. 2005 Color Infrared Photography -- Area of Interest

3.2.4 Management Measures Not Carried Forward for Further Analysis

Of the 105 original measures developed, 91 measures (Table 3.2) were eliminated from further consideration due to screening of the hydrologic subunits, failure to partially meet project objectives, or the measure was deemed impracticable or ineffective due to project constraints. Fourteen measures were retained for further study (Table 3.2). Vegetative planting, a non-structural measure, was retained in conjunction with other measures; not as a standalone measure, because it was determined that plantings would not provide benefits without restored hydrologic connectivity. Some measures, such as dedicated dredging with ring levees, were considered as mitigation of RSLR. However, further investigation suggested that impacts would be great and benefits would be low; these measures were eliminated.

Table 3.2. Management Measures Considered with Screening Results

Management Measure	Description	Screening Results
BD-01	Degradation of the entire ARDC dredged material berm	Eliminated due to a lack of practicality. Removal of large portions or all of the dredged material berms is not necessary to achieve any of the project objectives. Bank openings are viewed as a more feasible measure. Implementation of this measure would also destroy existing upland habitat found within the study area.
BO-01	Opening at confluence of Bayou Pierre and ARDC at LA-22, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, the Petite Amite does provide adequate hydrologic connectivity. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
BO-02	Opening at confluence of Bayou Pierre and ARDC south of LA-22, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, the Petite Amite does provide adequate hydrologic connectivity. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
BO-03	Openings along ARDC throughout study area, at intersections of relict channels	Eliminated as a standalone measure, but other BO and CC measures would be located in the low areas of relic channels as much as practicable.
BO-04	Openings on lower Amite River, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
BO-05	Openings on lower Amite River, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
BO-06	Openings on south bank Bayou Chene Blanc, NE-1	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas; and habitat would have little to no improvement with these measures.
BO-07	Openings on south bank Bayou Chene Blanc, NE-2	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas; and habitat would have little to no improvement with these measures.
BO-08	Openings on west bank Blind River, NE-2	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas; and habitat would have little to no improvement with these measures.
BO-09	Openings on west bank Blind River, SE-1	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas; and habitat would have little to no improvement with these measures.

Management Measure	Description	Screening Result
BO-10	Openings on west bank Blind River, SE-2	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas, and habitat would have little to no improvement with these measures.
BO-11	Openings on east bank of Petite Amite River, NE-1	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas, and habitat would have little to no improvement with these measures.
BO-12	Openings on east bank of Petite Amite River, SE-1	Eliminated because additional field investigation determined adequate hydrologic connectivity already exists in these areas, and habitat would have little to no improvement with these measures.
BO-13	Openings on north bank ARDC, NE-1	Eliminated because it would be problematic to develop a bank opening through an existing subdivision, due to utility relocations; hydrologic connectivity could be achieved for the easternmost portion of NE-1 (the only portion that is degraded) via a connection through NE-2.
BO-14	**Openings on north bank ARDC, NE-2**	**Retained (Meets Objective 2, Objective 3 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
BO-15	**Openings on south bank ARDC, SE-2**	**Retained (Meets Objective 2, Objective 3 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
BO-16	**Openings on south bank ARDC, SE-1**	**Retained (Meets Objective 2, Objective 3 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
BO-17	Openings on south bank ARDC, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, the Petite Amite does provide adequate hydrologic connectivity. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
BO-18	Openings on south bank ARDC, SW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
BO-19	Openings on north bank ARDC, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.

Management Measure	Description	Screening Result
BO-20	Openings on north bank ARDC, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
BO-21	Openings on west bank of Petite Amite River, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, the Petite Amite does provide adequate hydrologic connectivity. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
BO-22	Openings on west bank of Petite Amite River, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
BO-23	**Openings on railroad grade, NE-1/NE-2**	**Retained (Meets Objective 2, Objective 3 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
BO-24	**Openings on railroad grade, SE-1/SE-2**	**Retained (Meets Objective 2, Objective 3 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
CC-01	**Conveyance channel, NE-1/NE-2**	**Retained (Meets Objective 1, Objective 2, Objective 3 and Objective 4)**
CC-02	Conveyance channel, NW-1/NW-2	Eliminated because hydrologic connectivity already exists within both subunits and little to no habitat restoration would occur. Conveyance channels were retained as a design feature and combined with bank openings. This combination was retained for further study.
CC-03	**Conveyance channel, SE-1/SE-2**	**Retained (Meets Objective 1, Objective 2 and Objective 4). Would provide connectivity for freshwater, nutrients, and sediments when combined with a bank opening.**
CC-04	Conveyance channel, SW-1/SW-2	Historic aerial photograph analysis and field investigations indicate that little to no degradation exists in the areas near the convergence of SW-1 and SW-2. Adequate hydrologic connectivity already exists within both subunits. Therefore, no opportunities exist for restoration. Conveyance channels were retained as a design feature and combined with bank openings. This combination was retained for further study, while the stand-alone measure was eliminated.
CD-01	Channel dredging, Bayou Chene Blanc, NE-1/NE-2	Eliminated because further field investigations determined that surface water connections in this portion of these areas are adequate. Furthermore, it was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.

Management Measure	Description	Screening Result
CD-02	Channel dredging, Bayou Pierre, NW-1/NW-2, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated. Furthermore, it was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
CD-03	Channel dredging, Blind River, NE-2/SE-1/SE-2	Eliminated because further field investigations indicated that these areas are hydrologically connected with Blind River and therefore, no restoration opportunities exist. Furthermore, it was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
CD-04	Channel dredging, Lower Amite River, NW-1/NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, it was determined that the river has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
CD-05	Channel dredging, Petite Amite River, NW-2/NE-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and that hydrologic connectivity already exists for this portion of the study area. Furthermore, it was determined that the river has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
CD-06	Channel dredging, Petite Amite River, SW-2/SE-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and that hydrologic connectivity already exists for this portion of the study area. Furthermore, it was determined that the river has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
CS-01	Clearing and snagging of Bayou Chene Blanc, NE-1/NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and that hydrologic connectivity already exists for this portion of the study area. Furthermore, clearing and snagging is not needed and would result in no added flow though the bayou.
CS-02	Clearing and snagging of Bayou Pierre, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
CS-03	Clearing and snagging of Bayou Pierre, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, clearing and snagging is not needed and would result in no added flow though the bayou.

Management Measure	Description	Screening Result
CS-04	Clearing and snagging of Bayou Pierre, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, clearing and snagging is not needed and would result in no added flow though the bayou.
CS-05	Clearing and snagging of Blind River, NE-2/SE-2	Eliminated because further field investigations determined that surface water connections in this area are adequate. Furthermore, clearing and snagging is not needed and would result in no added flow though the river.
CS-06	Clearing and snagging of lower Amite River, NW-1/NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, clearing and snagging is not needed and would result in no added flow though the river.
CS-07	Clearing and snagging of Petite Amite River, NW-2/NE-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, clearing and snagging is not needed and would result in no added flow though the river.
CS-08	Clearing and snagging of Petite Amite River, SW-2/SE-1	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
DD-01	Dedicated dredging of borrow areas and placement within ring-levees to combat subsidence and sea level rise within the study area	Eliminated because these measures would result in a substantial habitat loss, placement of this material would be difficult, and the ecosystem benefits would be limited.
HC-01	**Placement of dredged material from the construction of conveyance channels as additional upland and bottomland hardwood habitat in NE-1/NE-2**	**Retained (Meets Objective 4)**
HC-02	Placement of dredged material from the construction of conveyance channels as additional upland and bottomland hardwood habitat in NW-1/NW-2	Eliminated because hydrologic connectivity already exists within both subunits and little to no habitat restoration would occur, therefore conveyance channels were eliminated as a management measure within these subunits.

Management Measure	Description	Screening Result
HC-03	**Placement of dredged material from the construction of conveyance channels as additional upland and bottomland hardwood habitat in SE-1/SE-2**	**Retained (Meets Objective 4)**
HC-04	Placement of dredged material from the construction of conveyance channels as additional upland and bottomland hardwood habitat in SW-1/SW-2	Eliminated because hydrologic connectivity already exists within both subunits and little to no habitat restoration would occur, therefore conveyance channels were eliminated as a management measure within these subunits.
MLM-01	Increasing the overall freshwater content within Lake Maurepas in order to reduce saltwater intrusion from within this area.	Eliminated because the reduction of salinity levels through the introduction of freshwater from other rivers or lakes is beyond the scope of this project. This issue will be addressed by other projects outside the study area.
MPDT-1	Removing the entire railroad grade	Eliminated because much of the existing railroad grade is characterized as bottomland hardwood habitat and complete removal of the railroad grade would destroy this important and valuable habitat.
MPDT-2	Dredging the entire railroad grade to use as conveyance	Eliminated because implementation would destroy existing bottomland hardwood wildlife habitat. In addition, the railroad grade is not located in an area that would effectively drain the swamp. Conveyance channels would provide a more effectively drain of the swamp.
MPDT-3	Constructing openings in the banks of Blind River at NE-3.	Eliminated because no impoundment exists within NE-3, therefore bank openings would provide no additional hydrologic connectivity or benefits.
MPDT-4	Dredging Bayou Chene Blanc	Eliminated because no dredging is needed. It was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
MPDT-5	Clearing and snagging Bayou Chene Blanc and Little Bayou Chene Blanc	Eliminated because clearing and snagging is not needed and would result in no added flow though the bayou.
MPDT-6	**NE-2 dredging the pullboat channel**	**Retained (Meets Objective 1, Objective 2 and Objective 4)**

Management Measure	Description	Screening Result
MPDT-7	Introducing secondary treated wastewater into SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated.
MPDT-8	**Use dredged ARDC opening material to create additional habitat**	**Retained (Meets Objective 4)**
PU-01	Hydraulic Pumps, NE-1	Eliminated because the OMRR&R and size of pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-02	Hydraulic Pumps, NE-2	Eliminated because the OMRR&R and size of pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-03	Hydraulic Pumps, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Additionally, the OMRR&R and size of the pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-04	Hydraulic Pumps, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Additionally, the OMRR&R and size of the pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-05	Hydraulic Pumps, SE-1	Eliminated because the OMRR&R and size of pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.

Management Measure	Description	Screening Result
PU-06	Hydraulic Pumps, SE-2	Eliminated because the OMRR&R and size of pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-07	Hydraulic Pumps, SW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Additionally, the OMRR&R and size of the pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-08	Hydraulic Pumps, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated. Additionally, the OMRR&R and size of the pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
PU-09	Hydraulic Pumps with a Ring-Levee, SE-1/SE-2, NE-1/NE-2	Eliminated because the OMRR&R and size of pumps required to improve the swamp habitat are impracticable and would have reduced reliability as well as lost restoration opportunities when the pumps fail.
RG-01	Removal of entire railroad grade, NE-1/NE-2	Eliminated because much of the existing railroad grade is characterized as bottomland hardwood habitat and complete removal of the railroad grade would destroy this important and valuable habitat.
RG-02	Removal of entire railroad grade, SE-1/SE-2	Eliminated because much of the existing railroad grade is characterized as bottomland hardwood habitat and complete removal of the railroad grade would destroy this important and valuable habitat.
RS-01	Removal of entire ARDC north dredged material berm, NE-1	Eliminated because complete removal is not needed to achieve adequate connectivity into the adjacent swamp habitat and removal would lead to a large loss of bottomland hardwood habitat.

Management Measure	Description	Screening Result
RS-02	Removal of entire ARDC north dredged material berm, NE-2	Eliminated because complete removal is not needed to achieve adequate connectivity into the adjacent swamp habitat and removal would lead to a large loss of bottomland hardwood habitat.
RS-03	Removal of entire ARDC north dredged material berm, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, removal would lead to a large loss of bottomland hardwood habitat.
RS-04	Removal of entire ARDC north dredged material berm, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, removal would lead to a large loss of bottomland hardwood habitat.
RS-05	Removal of entire ARDC south dredged material berm, SE-1	Eliminated because complete removal is not needed to achieve adequate connectivity across the railroad grade and removal would lead to a large loss of bottomland hartdwood habitat.
RS-06	Removal of entire ARDC south dredged material berm, SE-2	Eliminated because complete removal is not needed to achieve adequate connectivity across the railroad grade and removal would lead to a large loss of bottomland hartdwood habitat.
RS-07	Removal of entire ARDC south dredged material berm, SW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, removal would lead to a large loss of bottomland hardwood habitat.
RS-08	Removal of entire ARDC south dredged material berm, SW-2	Historic aerial photograph analysis and field investigations indicated that while some minor degradation exists within portions of SW-2, adequate hydrologic connectivity exists. Analysis also revealed that canopy loss within SW-2 existed before the ARDC was constructed. Therefore, no opportunity for restoration exists and the measure was eliminated. Furthermore, removal would lead to a large loss of bottomland hardwood habitat.
RS-09	Removal of both ARDC dredged material berms, entire lengths	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, removal would lead to a large loss of bottomland hardwood habitat.
SD-01	Spray dredging and ring-levees for degraded areas within study area	Eliminated because these measures would result in a substantial habitat loss, placement of this material would be difficult and the ecosystem benefits would be limited.

Management Measure	Description	Screening Result
SI-01	Siphons, NE-1	Eliminated because the OMRR&R, and size and volume of siphons required to improve the swamp habitat is impracticable and would have reduced reliability. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat.
SI-02	Siphons, NE-2	Eliminated because the OMRR&R, and size and volume of siphons required to improve the swamp habitat is impracticable and would have reduced reliability. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat.
SI-03	Siphons, NW-1	Eliminated because the proposed area of implementation is not considered degraded and there would be no habitat improvement with these measures. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat. Furthermore, field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
SI-04	Siphons, NW-2	Eliminated because the proposed area of implementation is not considered degraded and there would be no habitat improvement with these measures. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat. Furthermore, field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
SI-05	Siphons, SE-1	Eliminated because the OMRR&R, and size and volume of siphons required to improve the swamp habitat is impracticable and would have reduced reliability. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat.
SI-06	Siphons, SE-2	Eliminated because the OMRR&R, and size and volume of siphons required to improve the swamp habitat is impracticable and would have reduced reliability. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat.
SI-07	Siphons, SW-1	Eliminated because the proposed area of implementation is not considered degraded and there would be no habitat improvement with these measures. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat. Furthermore, field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.

Management Measure	Description	Screening Result
SI-08	Siphons, SW-2	Eliminated because the proposed area of implementation only exhibits minor degradation and there would be no habitat improvement with these measures. Additionally, since little head differential is present, it would be very difficult for siphons to function to move enough volume of fresh water to improve the habitat. Furthermore, field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project.
SR-01	Shoal removal, mouth of Amite River (outside study area)	Eliminated because removal of these shoals would have no hydraulic effect on the ARDC in the degraded areas. Field investigations determined that water exchange in this area is adequate and these measures would not affect water surfaces controlled by Lake Maurepas.
SR-02	Sediment plug removal, mouth of Bayou Pierre, east of LA 22, SW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas have no opportunity for restoration. Furthermore, it was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating.
SR-03	Shoal removal, mouth of Blind River (outside study area)	Eliminated because removal of these shoals would have no hydraulic effect on the ARDC in the degraded areas. Field investigations determined that water exchange in this area is adequate and these measures would not affect water surfaces controlled by Lake Maurepas.
VE-01	Increase the size and number of gaps in the railroad ridge	Numerous natural cuts in the railroad grade already exist within degraded areas. Cuts in the railroad grade provide some connectivity in specific areas and help facilitate sheet flow when combined with other alternatives, but these cuts alone would not provide the hydrologic connectivity needed to restore the degraded areas within the swamp.
VE-02	Use the railroad ridge as an oak tree habitat	Further field investigation determined that a quality bottomland hardwood habitat already exists on the railroad grade and there would be little to no habitat improvements to plant additional trees.
VE-03	Maximize long-term fresh water content of Lake Maurepas as a potential buffer to a major saltwater inflow event	Eliminated because it does not meet the project objectives for the LCA ARDC Modification project and is beyond the scope of the authorized action.
VE-04	**Use dredged railroad material to create additional habitat**	**Retained (Meets Objective 4)**

Management Measure	Description	Screening Result
VP-01	**Vegetative planting, such as (including bald cypress and tupelo seedlings), in degraded areas**	**Retained (Meets Objective 4)**
VP-02	**Vegetative planting, such as (including water oak and sweetgum seedlings), on material placed from excavation of the dredged material berms.**	**Retained (Meets Objective 4)**
WC-01	Construction of weir on north ARDC bank, NE-1	Eliminated because these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-02	Construction of weir on north ARDC bank, NE-2	Eliminated because these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-03	Construction of weir on north ARDC bank, NW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-04	Construction of weir on north ARDC bank, NW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas have no opportunity for restoration. Furthermore, these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-05	Construction of weir on south ARDC bank, SE-1	Eliminated because these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.

Management Measure	Description	Screening Result
WC-06	Construction of weir on south ARDC bank, SE-2	Eliminated because these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-07	Construction of weir on south ARDC bank, SW-1	Eliminated because further field investigations and historic aerial photograph analysis indicated that these areas were not degraded and therefore did not meet the objectives of the project. Furthermore, these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WC-08	Construction of weir on south ARDC bank, SW-2	Eliminated because further field investigations and historic aerial photograph analysis indicated that these no opportunity for restoration exists for this subunit. Furthermore, these structures would impede flow and connectivity. Weirs also could lead to semi-impounding situations, which would actually harm, rather than restore habitat. More open structures are needed to create connectivity and maximize the freshwater, nutrient, and sediment input.
WR-01	Rehabilitation of existing weir at French Settlement, NW-1/SW-1	Eliminated because Lake Maurepas water levels control the water levels in the ARDC near the degraded areas. Therefore, changes to this existing weir would have little effect on restoring the degraded habitat. In addition, this weir is outside the LCA ARDC study area.
WWR-01	Reintroduction of wastewater from local industries and campsites	Eliminated because implementation this measure would result in environmental damages that outweigh any benefits. Additionally, the most highly-degraded portions of the study area are located the furthest from potential wastewater sources.

BO = Bank Openings; BD= Berm Degradation; CC = Conveyance Channels; CD = Channel Dredging; CS = Clearing and Snagging; DD = Dedicated Dredging; HC=Habitat Creation; MLM= Maximize Lake Maurepas Freshwater Content to act as a buffer; MPDT = Measures from Project Delivery Team; PU = Pumps; RG = Railroad Grade; RS = Removal of Dredged Material Berm; SD = Spray Dredging; SI = Siphons; SR = Shoal Removal; VE = Value Engineering; VP = Vegetative Planting; WC = Weir Construction; WR = Weir Rehabilitation; WRR= Wastewater Reintroduction;

Note: Bolded measures were retained for further consideration.

3.3 PRELIMINARY ALTERNATIVE PLANS

The plan formulation process includes development of a reasonable range of alternative plans to address the specific problems, needs, and objectives of the study described in Section 2. Alternative plans are combinations of management measures. The 14 restoration measures retained for further consideration were combined and developed into a preliminary array of 45 alternatives that collectively met study goals and objectives and were within the defined study constraints. All alternatives developed and the reasons for eliminating particular alternatives are listed in Table 3.3.

Table 3.3. Description and Screening Results of Alternatives, Including the Final Array

Alternative	Description	Screening Result
1	One or more openings in the north bank of the ARDC in NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
2	One or more openings in the north bank of the ARDC in NE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
3	One or more openings in the north bank of the ARDC in NE-2; dredging bayous leading from Blind River into NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years.
4	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2 and dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.

Alternative	Description	Screening Result
5	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23,VE-04)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore, dredging the bayous would not be effective or sustainable.
6	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore, dredging the bayous would not be effective or sustainable.
7	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in NE-1/NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, VE-04, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
8	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in NE-1/NE-2; dredged material berm and swamp floor vegetative plantings (BO14, MPDT-8, BO-23, VE-04, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
9	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-24, VE-04)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
10	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-24, VE-04, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.

Alternative	Description	Screening Result
11	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-24, VE-04, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, the bayous are not effective or sustainable. Therefore, dredging the bayous would not be effective or sustainable.
12	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-24, VE-04, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
13	One or more openings in the north bank of the ARDC in NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-16)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
14	One or more openings in the north bank of the ARDC in NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-16, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
15	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-16, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.

Alternative	Description	Screening Result
16	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-16, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years.
17	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in SE-1/SE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-24, VE-04, BO-16)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
18	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in SE-1/SE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-24, VE-04, BO-16, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
19	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in SE-1/SE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-24, VE-04, BO-16, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
20	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in SE-1/SE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-24, VE-04, BO-16, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.

Alternative	Description	Screening Result
21	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, VE-04, BO-24)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, this alternative would result in limited benefits by only cutting gaps into the railroad grade in SE-1/SE-2 without also improving hydraulic connectivity with the ARDC through proposed conveyance channels.
22	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-24, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, this alternative would result in limited benefits by only cutting gaps into the railroad grade in SE-1/SE-2 without also improving hydraulic connectivity with the ARDC through proposed conveyance channels.
23	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, BO-24, VE-04, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, this alternative would result in limited benefits by only cutting gaps into the railroad grade in SE-1/SE-2 without also improving hydraulic connectivity with the ARDC through proposed conveyance channels. Dredging would benefit only a limited area as well. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
24	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, BO-24, VE-04, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that added conveyance channels into the swamp, was necessary to achieve hydrological connectivity and would result in greater benefits. Furthermore, this alternative would result in limited benefits by only cutting gaps into the railroad grade in SE-1/SE-2 without also improving hydraulic connectivity with the ARDC through proposed conveyance channels. Dredging would benefit only a limited area as well. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.

Alternative	Description	Screening Result
25	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, VE-04, BO-16)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
26	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-16, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
27	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, VE-04, BO-24, BO-16)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
28	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, BO-24, VE-04, BO-16, VP-01, VP-02)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
29	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, VE-04, BO-16, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
30	One or more openings in the north bank of the ARDC in NE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-16, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure.
31	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more in the railroad grade in SE-1/SE-2; dredging pullboat traces/bayous leading from Blind River into NE-2; one or more openings in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, VP-02, BO-23, BO-24, VE-04, BO-16, MPDT-6)	This alternative was eliminated because it was determined that just bank openings would not be effective without conveyance channels to provide hydrological connectivity into the swamp. Therefore bank openings were eliminated as a stand-alone measure. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.

Alternative	Description	Screening Result
32	One or more openings in the north bank of the ARDC in NE-2; one or more gaps in the railroad grade in NE-1/NE-2; one or more gaps in the railroad grade in SE-1/SE-2; dredging pullboat traces/bayous leading from Blind River into NE-2, one or more openings in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-24, BO-16, VP-01, VP-02, MPDT-6)	This alternative was eliminated because it was determined that added conveyance channels into the swamp, was necessary to achieve hydrological connectivity and would result in greater benefits. Furthermore, dredging would benefit only a limited area. It was determined that the bayous have already reached a natural equilibrium and would therefore silt back in within a few years. Therefore, dredging the bayous would not be effective or sustainable.
33	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut in the railroad grade located approximately 0.9 miles north of the ARDC in NE-1/NE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, CC-01, VP-01, VP-02, HC-01).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
34	One opening in the south bank of the ARDC in SE-1 west of and within close proximity to the railroad grade that extends east and through the railroad grade between SE-1/SE-2 into SE-2; bifurcated conveyance channels; sidecasting of dredged material; two cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-24, VE-04, BO-15, BO-16, CC-03, VP-01, VP-02, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
35	One opening in the south bank of the ARDC in SE-1; bifurcated conveyance channels; sidecasting of dredged material; dredged material berm plantings (BO-16, MPDT-8, VP-02, CC-03, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
36	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut in the railroad grade located approximately 0.9 miles north of the ARDC in NE-1/NE-2; one opening in the south bank of the ARDC in SE-1 west of and within close proximity to the railroad grade that extends east and through the railroad grade between SE-1/SE-2 into SE-2; two cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-24, BO-15, BO-16, CC-01, CC-03, VP-01, VP-02, HC-01, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**

Alternative	Description	Screening Result
37	Two openings in the south bank of the ARDC in SE-1; bifurcated conveyance channels; sidecasting of dredged material; one opening located just west of the natural ridge that intersects the south bank of the ARDC and one west of and within close proximity to the railroad grade, that extends east and through the railroad grade between SE-1 and SE-2 into SE-2; two additional cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (MPDT-8, BO-15, BO-16, BO-24, VE-04, CC-03, VP-01, VP-02, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
38	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut located approximately 0.9 miles north of the ARDC in NE-1/NE-2; one opening in the south bank of the ARDC in SE-1; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-16, BO-23, VE-04, CC-01, CC-03, VP-01, VP-02, HC-01, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
39	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; two openings in the south bank of the ARDC in SE-1, with one cut located west of and within close proximity to the railroad grade, that extends east and through the railroad grade between SE-1/SE-2 into SE-2; three cuts in the railroad grade, one cut located approximately 0.9 miles north of the ARDC in NE-1/NE-2 and two additional cuts in the railroad grade located 0.8 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm and swamp floor vegetative plantings (BO-14, MPDT-8, BO-23, BO-24, VE-04, BO-15, BO-16, CC-01, CC-03, VP-01, VP-02, HC-01, HC-03).	**Retained as a final alternative. This alternative would provide the connectivity for freshwater, nutrients, and sediments. Additionally, the alternative would meet all project objectives.**
40	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut in the railroad grade located approximately 0.9 miles north of the ARDC in NE-1/NE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, CC-01, VP-02, HC-01).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.

Alternative	Description	Screening Result
41	One opening in the south bank of the ARDC in SE-1 west of and within close proximity to the railroad grade that extends east and through the railroad grade between SE-1/SE-2 into SE-2; bifurcated conveyance channels; sidecasting of dredged material; two cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm vegetative plantings (BO-24, VE-04, BO-15, BO-16, CC-03, VP-02, HC-03).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.
42	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut in the railroad grade located approximately 0.9 miles north of the ARDC in NE-1/NE-2; one opening in the south bank of the ARDC in SE-1 west of and within close proximity to the railroad grade that extends east and through the railroad grade between SE-1/SE-2 into SE-2; two cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, BO-23, VE-04, BO-24, BO-15, BO-16, CC-01, CC-03, VP-02, HC-01, HC-03).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.
43	Two openings in the south bank of the ARDC in SE-1; bifurcated conveyance channels; sidecasting of dredged material; one opening located just west of the natural ridge that intersects the south bank of the ARDC and one west of and within close proximity to the railroad grade, that extends east and through the railroad grade between SE-1 and SE-2 into SE-2; two additional cuts in the railroad grade located 0.9 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm vegetative plantings (MPDT-8, BO-15, BO-16, BO-24, VE-04, CC-03, VP-02, HC-03).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.
44	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; one cut located approximately 0.9 miles north of the ARDC in NE-1/NE-2; one opening in the south bank of the ARDC in SE-1; dredged material berm vegetative plantings (BO-14, MPDT-8, BO-16, BO-23, VE-04, CC-01, CC-03, VP-02, HC-01, HC-03).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.

Alternative	Description	Screening Result
45	Three openings in the north bank of the ARDC in NE-2 with the westernmost cut also extending through the railroad grade into NE-1; bifurcated conveyance channels; sidecasting of dredged material; two openings in the south bank of the ARDC in SE-1, with one cut located west of and within close proximity to the railroad grade, that extends east and through the railroad grade between SE-1/SE-2 into SE-2; three cuts in the railroad grade, one cut located approximately 0.9 miles north of the ARDC in NE-1/NE-2 and two additional cuts in the railroad grade located 0.8 and 2 miles south of the ARDC in SE-1/SE-2; dredged material berm vegetative plantings (BO-14, MPDT-8, BO-23, BO-24, VE-04, BO-15, BO-16, CC-01, CC-03, VP-02, HC-01, HC-03).	This alternative was eliminated because it was determined that vegetative plantings, located within the highly-degraded portions of the study area, are essential to the near-term restoration of critical freshwater swamp habitat. It was determined that natural regeneration would not occur within these areas for several decades without the implementation of vegetative plantings.

3.3.1 Development of Alternative Plans

The development of alternatives is an iterative process and alternatives were revised and added throughout the progression of the project. If an alternative was revised and changed from what was initially considered the alternative received a new number designation. Through the iterative planning process, a total of 45 alternatives were developed. The final array consisted of seven action Alternatives 33-39 and the No-Action Alternative. Within the final array, Alternatives 33, 34, and 35 represent individual Alternatives, while Alternatives 36, 37, 38, and 39 are combinations of the Alternatives 33, 34, and 35.

Vegetative plantings were added to the alternative arrays. Based on research and additional site investigations, it was determined that the most highly degraded areas within NE-2 and SE-2 would need to consider vegetative plantings on the swamp floor (Measure VP-01) as a component proposed within these subunits. (See Section 3.3.1.1 for further information). Planting of bottomland hardwood species were also added to alternatives (Measure VP-02) to beneficially use the dredged material placement resulting from excavation of the conveyance channels, by creating additional bottomland hardwood habitat.

Conveyance channels were added to the proposed gaps to ensure that a hydraulic connection between the ARDC and the adjacent swamp was achieved. The need for these conveyance channels were based on the hydrological and hydraulic analysis, field reconnaissance, and previous project experience on Davis Pond Freshwater Diversion project. The conveyance channel dimensions were based on the existing conveyance channels within the study area and were designed using the width, depth, and profile of existing sustainable channels. It was determined that if only gaps were constructed, without conveyance channels, there would not likely be enough water exchange to keep these gaps open or to improve the swamp habitat. It was also determined that gaps, with associated conveyance channels, would be

sustainable and allow for adequate water exchange between the ARDC and the impaired swamp.

3.3.1.1 Inclusion of Vegetative Plantings into Alternatives

Vegetative plantings in highly-degraded freshwater swamp habitats are a critical component utilized for establishing ecological restoration and obtaining ecological benefits. The Coastal Wetland Forest Conservation and Use Science Working Group (CWFCUSWG, 2005) indicated that: "In those areas where flooding prevents or limits the natural regeneration of the cypress-tupelo forest, artificial regeneration through tree planting is the only currently viable mechanism to regenerate the forest. Some swamps are altered to such a significant extent that even artificial regeneration is not possible." Once hydraulic connection is restored within a degraded freshwater swamp, tree vigor and stand productivity will increase (Shaffer *et al*. 2009). In areas with an existing canopy, mid-story, and established regeneration, vegetative plantings would not be necessary. These areas would have an adequate seed source and stocking levels needed to recover. However, if an area has degraded to the point that the canopy, mid-story, and established regeneration is limited or severely stressed, vegetative plantings are essential to achieve required stocking levels. If a natural seed source is not present for regeneration to become established, the areas that have already begun transition to marsh will continue the transition and the severely degraded swamp areas will not be able to convert back to a functioning swamp habitat. Due to the highly-degraded conditions found in portions of the LCA ARDC study area (NE-2 and SE-2), natural regeneration would not likely become established within the 50 year period of analysis and would not contribute to the restoration of this Near-Term critical habitat or meet the goals and objectives of the project. Additionally, vegetative plantings are needed to allow for the establishment of a native tree community by providing an opportunity for natural succession to occur prior to the establishment of invasive species, such as the Chinese tallow (*Sapium sebiferum*).

Reestablishing freshwater swamps through the implementation of vegetative plantings would generate healthy stand conditions and adequate canopy cover that will be necessary to establish a swamp prior to the onset of the effects of RSLR to the study area (Section 3.5.2). Over time, the effects of RSLR would continue to reach a point in which regeneration of native species is inhibited. Souther and Shaffer, 2000, indicated that newly-germinated cypress seedlings (less than two weeks of age) may be capable of surviving up to one and one-half months of submergence, but will suffer complete mortality after a period of submergence longer than 57 days. However, one-year-old seedlings experience up to a 75 percent survival rate when they are submerged for as long as five months (Souther and Shaffer 2000). Middleton (1995) suggests a longer dry period is necessary for cypress establishment. According to Middleton (1995), cypress seedlings require a drawdown of two years, and once established saplings will tolerate flooding better than seedlings. Additionally, Clason (personal communication) stated that the dry

period should extend through the growing season (April-October) during the first several years to allow seedlings to develop aggressive root systems.

Based on RSLR estimates and H&H modeling, it is estimated that much of the LCA ARDC study area would become permanently inundated within 40 years. Established freshwater swamp habitats can however provide good productivity, even once permanently inundated, provided there is adequate hydrologic connection, freshwater exchange, and an established stand with sufficient canopy cover. According to Dr. Gary Shaffer (personal communication, October 2009), cypress seedlings and trees should experience many pulses of nutrient-rich fresh water during the growing season, and once the seedlings are above high water, they can handle permanent flooding if the water is fresh and moving.

Invasive species also play a role in the degradation of freshwater swamp habitat within the study area. It is well documented that nutria (*Myocastor coypu*) will dramatically damage or destroy newly-planted seedlings and generally deter cypress regeneration (Conner and Toliver 1987, 1988, Johnson and Foote 1997, Flynn 1986, Conner and Day 1989, Myers *et al*. 1995, and Burnam and Mengak 2007). Myers *et al*. (1995) reported 100 percent mortality of unprotected seedlings in southeastern Louisiana and found that PVC protectors were an effective deterrent against nutria. In most cases, nutria seek out newly-planted seedlings and remove enough of the bark to kill the tree, normally within a few days or weeks. Nearly all mitigation banks that plant seedlings in areas where nutria exist use rodent guards or some form of nutria protection. Methods to control nutria include: habitat modification, exclusion, repellants, toxicants, trapping, and shooting (Burnam and Mengak 2007). Habitat modification may only prove partially-effective within the LCA ARDC study area because much of the area would become moderately inundated, which is ideal habitat for nutria. Repellants are marginally effective only in the short-term. Zinc phosphate is the only toxicant registered for nutria control, but may not be effective in a swamp environment because it may get diluted. Trapping and shooting may be effective, but would require coordination with the Louisiana Department of Wildlife and Fisheries and would be difficult to implement this method as part of any proposed action at this time. Therefore, it was determined that the most feasible method of nutria control would be an exclusion device that creates a barrier between the nutria and the tree, such as nutria guards. Nutria guards would act as a barrier on the newly-planted seedlings until the seedlings are large enough that the nutria would no longer damage or kill the tree.

In summary, it was determined that vegetative plantings along with the reestablishment of hydrologic connectivity are essential in highly degraded areas (NE-2 and SE-2) to reestablish a productive stand and adequate canopy cover where natural regeneration would not likely occur within the period of record and before the effects of RSLR permanently inundated the system. Permanent inundation would prevent planted or naturally regenerated species from becoming established; however, the added hydrologic connectivity will allow for continued success of an

already established swamp. Vegetative plantings are also needed for native trees to become reestablished and overcome competition from exotic and invasive species. Nutria exclusion methods will be included on all plantings to prevent nutria from damaging or killing newly-planted seedlings.

3.3.2 Description of Alternative Plans

Descriptions of all 45 alternatives developed are listed in Table 3.3. A matrix of management measures used to formulate each alternative is presented in Table 3.4.

3.3.3 Screening/Evaluation of Alternative Plans

Once developed, all alternatives were evaluated. This evaluation process was based on the ability of each alternative to meet project objectives, information gathered from field investigations, technical discussions, the overall effectiveness of each alternative, and the adverse environmental impacts that may result from the alternatives in question. Results of the screening were previously presented in Table 3.3. The rationale utilized for each screening criteria is detailed below.

- **Ability to Meet Project Objectives and Alternative Effectiveness** – Each alternative was evaluated on the basis of its ability to meet the four project objectives described in Section 2.4.2 of this report. Each action listed in the initial array of alternatives is made up of a combination of measures that were retained based on their ability to meet one or more of the project objectives. Therefore, a comparison was made between the alternatives to ascertain the degree to which the overall list of objectives would be accomplished by implementation of the proposed action. Some alternatives were not retained if a similar, but different alternative was deemed to be more effective in accomplishing the stated project objectives.
- **Information Gathered from Field Investigations** – The initial array of alternatives was also evaluated, based on information and data gathered during field investigations. For portions of the study area these field investigations helped to determine the level to which hydrologic connectivity exists, the existence of gaps within the dredged material berm and railroad grade, the level of existing degradation and the corresponding need for restoration, and the feasibility of implementing each alternative. This information helped determine which actions should be retained or screened out.
- **Adverse Environmental Impacts** – Any adverse environmental impacts that would result from the proposed alternatives were considered throughout the screening process as well. The environmental impacts considered ranged from habitat loss that would occur to reductions

Table 3.4. Matrix of Management Measures Used to Formulate the Alternatives

| Alternatives | Measures | | |

in environmental parameters such as water quality. The cumulative impacts to the local, state, and national resources similar to the study area were also considered. Only proposed actions with minimal to no adverse environmental impacts were retained for the final array.

Additional discussions involved aspects of each proposed alternative which could potentially effect screening decisions.

3.3.4 Alternative Plans Not Carried Forward for Further Analysis

Due to the need to facilitate flow from the interior swamp to the ARDC, it was determined that interface connections alone would not create enough connectivity. A true hydraulic connection would be needed to ensure enough water exchange between the ARDC and the swamp. Alternatives that did not have conveyance channels were eliminated and only alternatives with conveyance channels were retained through to the final array of alternatives (Table 3.3).

Alternatives were also eliminated if they included channel dredging. It was determined that the bayou has already reached a natural equilibrium and would therefore silt back in within a few years of over-excavating. Therefore, the implementation of channel dredging would provide reduced benefits and would be considered unsustainable. Alternatives which did not include the implementation of vegetative plantings, within the most highly-degraded portions of the study area, were eliminated based on the justification described in Section 3.3.1.1.

3.4 FINAL ARRAY OF ALTERNATIVES (ALTERNATIVES STUDIED IN DETAIL)

Each alternative within the final array was retained from the initial array of alternatives (Table 3.3). Seven alternatives plus the no-action alternative were further evaluated. Of the seven alternatives, three are individual alternatives, while the other four are combinations of these three. All alternatives within the final array would have no adverse impacts on flood control, navigation, recreation, or any type of Federal or non-Federal project.

3.4.1 No-Action Alternative (Future Without Project condition)

The No-Action Alternative consists of not implementing any restoration actions in the LCA ARDC study area and is the Future Without Project (FWOP) condition to which each alternative in the Final Alternative Array will be compared. This alternative would not address any of the project objectives stated in Section 2.4.2.

Consideration of the No-Action Alternative is required by National Environmental Policy Act [NEPA §1502.14(d)] and the current Federal Principles and Guidelines (P&G §1.10.1).

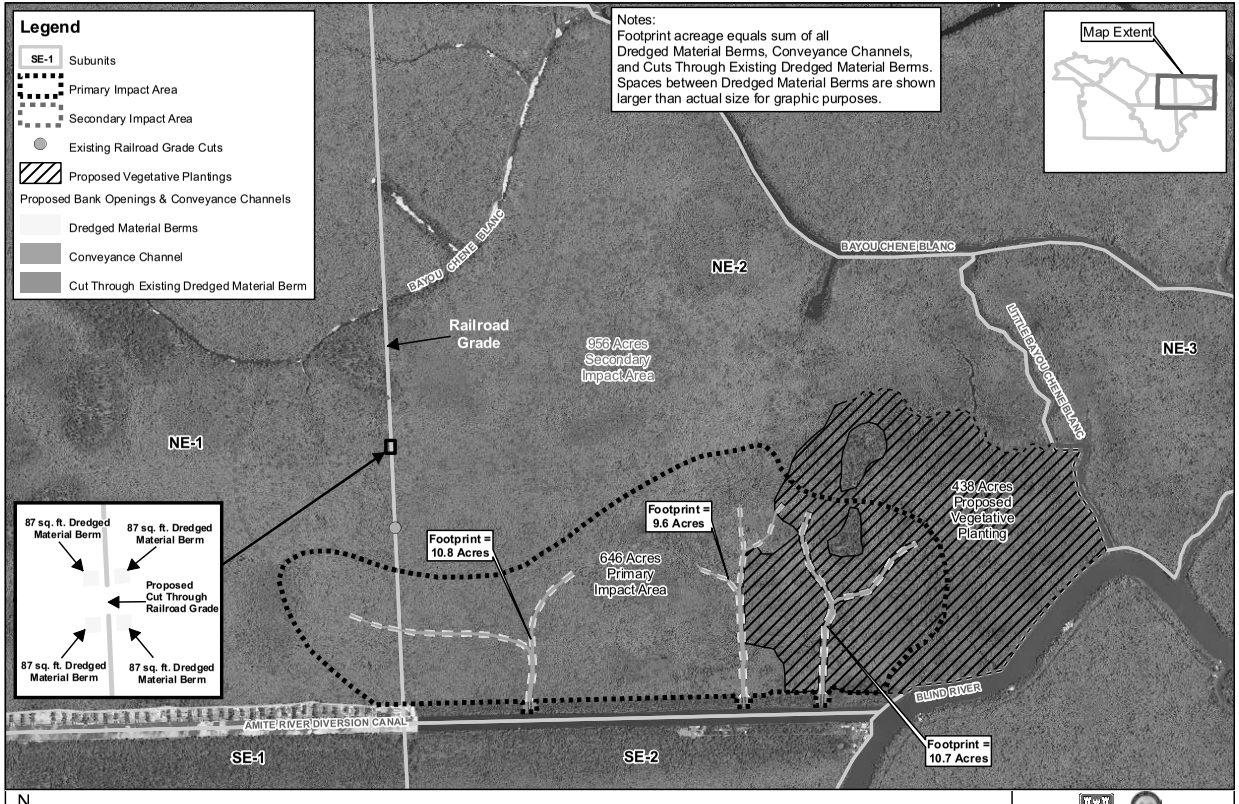
3.4.2 Alternative 33 (NE-1/NE-2)

Alternative 33 (Figure 3.4) includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channels would be sidecast on both sides of the proposed channels. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Initial and secondary vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement. This alternative would address all of the project objectives stated in Section 2.4.2.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, would be based on four design cross-sections (Figures 3.5 through 3.8). These cross-sections were developed in an effort to mimic natural, existing channels within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension,

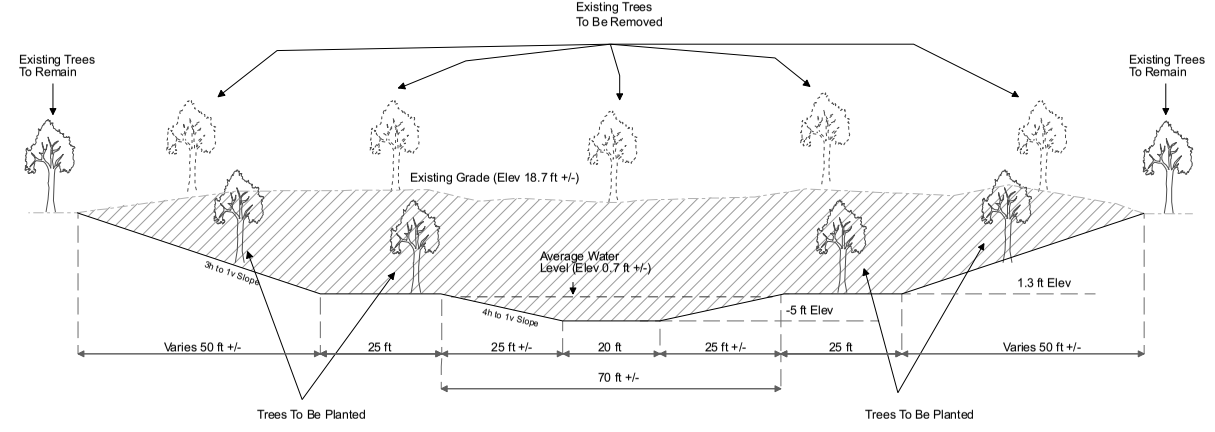


ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.4
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868



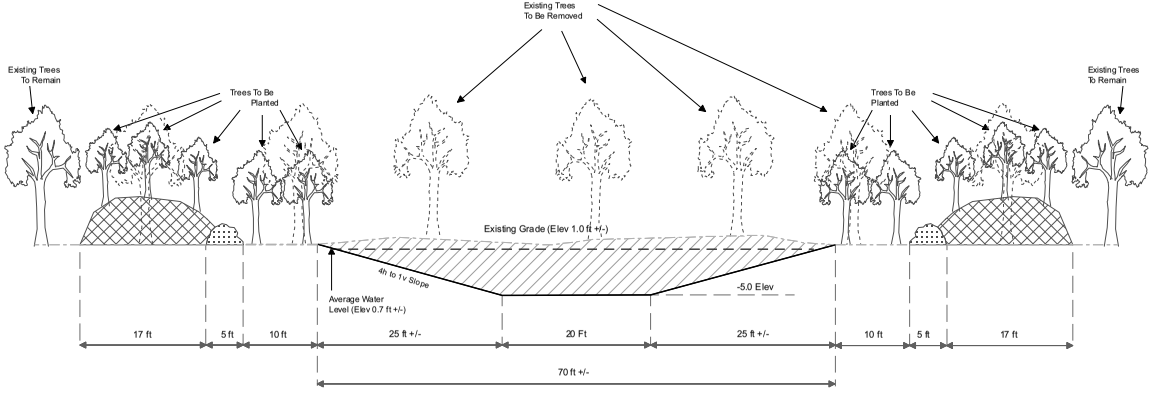
Legend

- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Area

Typical 70 ft. Cross Section through ARDC Dredged Material Berm

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3.5
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

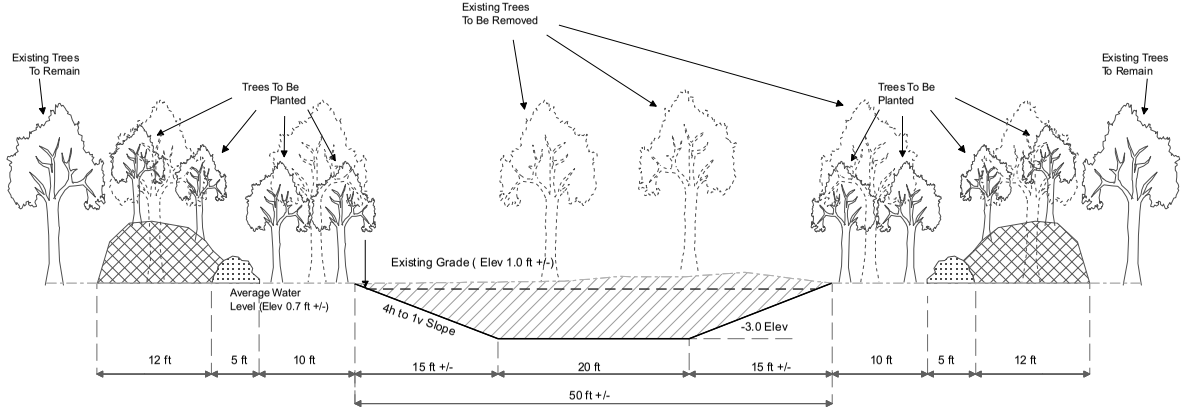
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 70 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3.6
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

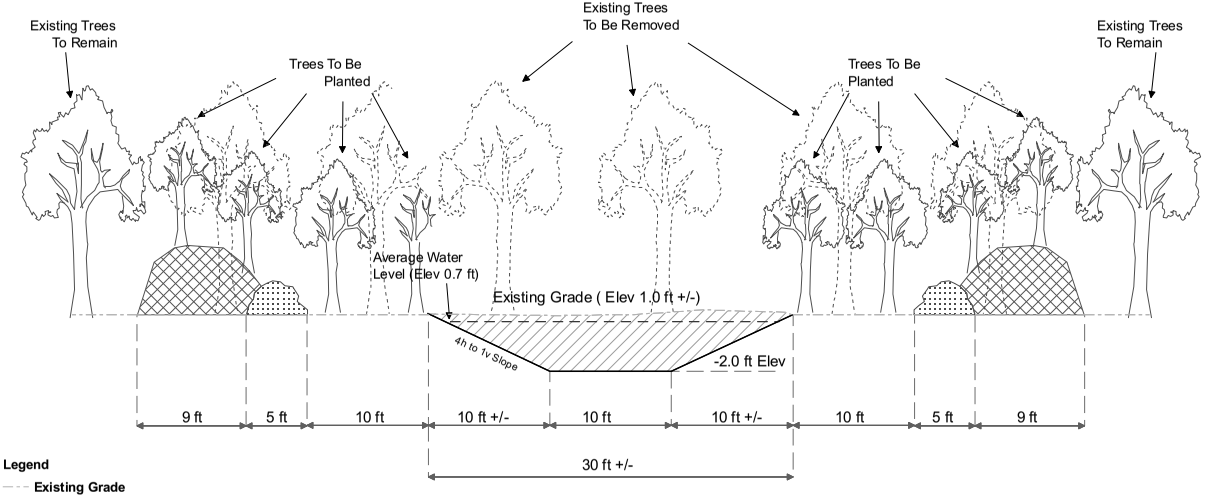
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 50 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3.7
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 30 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3.8
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741

and profile. The cross-sections include a 70-foot wide cut section with benches through the dredged material berm, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The benches are 25-foot wide flat areas, located above the average water level, on both sides of the conveyance channel. These benches will be included in the portions of the conveyance channel to be cut through the existing dredged material berms. The 70-foot cut section with benches was designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. The quantities associated with each alternative are found in Table 3.5. A typical depiction of the conveyance channels is found in Figure 3.9.

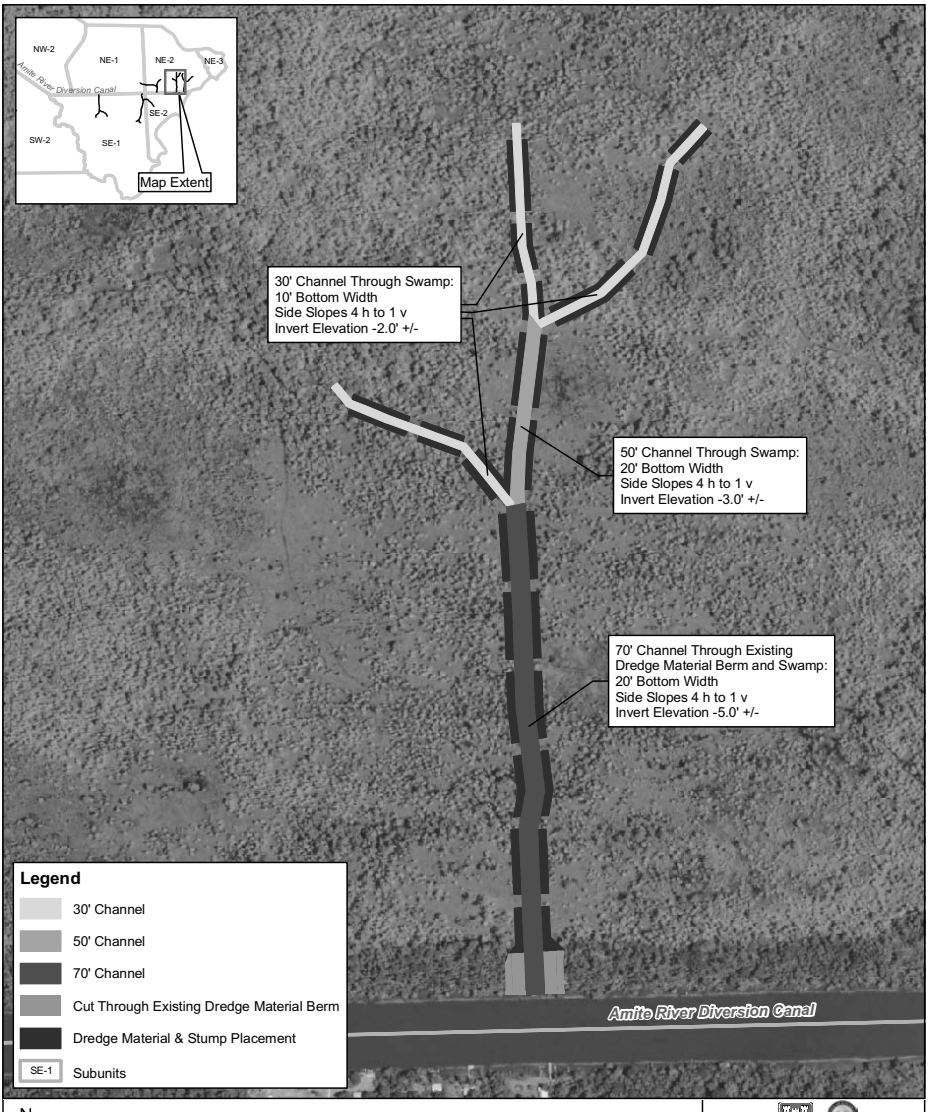
Table 3.5. Alternative Quantities

Alternative	Footprints (Acres)						Excavation (Cubic Yards)*		
	Berm		Swamp						
	Slopes and Benches	Channel	Channel	10' Gaps and Stumps	Material Placement	Total	Dredged Material Berm Cut	Channel Cut	Total
33	1.8	0.8	17.8	5.8	5.0	31.2	13,753	81,694	95,447
34	2.5	0.9	9.6	3.1	2.7	18.8	27,867	45,873	73,740
35	1.8	0.6	6.6	2.1	2.2	13.3	25,527	34,941	60,468
36	4.3	1.7	27.4	8.8	7.8	50.0	41,620	127,567	169,187
37	4.3	1.5	16.2	5.2	4.9	32.1	53,394	80,814	134,208
38	3.6	1.4	24.4	7.9	7.2	44.5	39,280	116,635	155,915
39	6.1	2.3	34.0	11.0	9.9	63.3	67,147	162,508	229,655

3.4.3 Alternative 34 (SE-1/SE-2)

Features of Alternative 34 (Figure 3.10) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 would facilitate hydrologic connectivity between the ARDC, SE-1, and SE-2.
- Dredged material (2.7 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced. Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 2.7 acres of dredged material berm.
- Two cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles south of the ARDC. The second cut would be approximately 2.0 miles south of the ARDC.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 487 acres of the swamp floor.



N

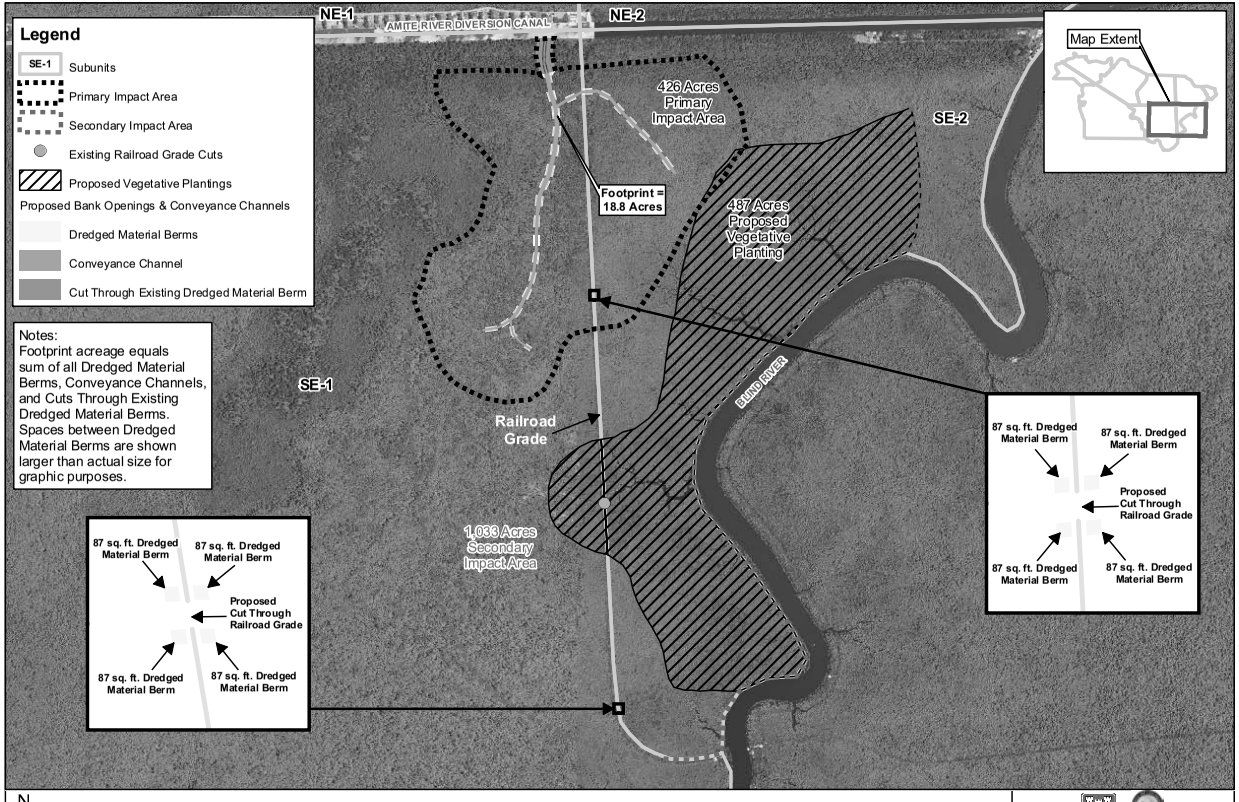
0 200 400 600 Feet

TYPICAL CONVEYANCE CHANNEL

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.9
Date: January 2010
Scale: 1:5,600
Source: USDA/GEC
Map ID: 27850108-1889


Legend
SE-1
Subunits
Primary Impact Area
Secondary Impact Area
Existing Railroad Grade Cuts
Proposed Vegetative Plantings
Proposed Bank Openings & Conveyance Channels
Dredged Material Berms
Conveyance Channel
Cut Through Existing Dredged Material Berm
Notes:
Footprint acreage equals sum of all Dredged Material Berms, Conveyance Channels, and Cuts Through Existing Dredged Material Berms. Spaces between Dredged Material Berms are shown larger than actual size for graphic purposes.
NE-1
AMITE RIVER DIVERSION CANAL
NE-2
SE-1
SE-2
426 Acres Primary Impact Area
Footprint = 18.8 Acres
487 Acres Proposed Vegetative Planting
Railroad Grade
1,038 Acres Secondary Impact Area
BLIND RIVER
Map Extent
87 sq. ft. Dredged Material Berm
Proposed Cut Through Railroad Grade
N
0
1,000
2,000
3,000
Feet
ALTERNATIVE 34
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 3.10
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1869

- Installation of nutria guards on all newly planted trees to protect against tree loss.

The opening in the south bank of the ARDC, coupled with the two gaps in the railroad grade, would facilitate hydrologic connectivity between the ARDC, SE-1, and SE-2. These openings would promote an influx of fresh water, nutrients, and sediments into these areas, which would help flush high salinity waters from the swamp, restore the degraded swamp habitat, and reverse the transition to marsh and open water. Alternative 34 would benefit approximately 1,459 acres of existing freshwater swamp, recreate 146 acres of freshwater swamp from freshwater marsh, and create 2.7 acres of upland habitat from dredged material placement. This alternative would address all the project objectives stated in Section 2.4.2.

Descriptions of the proposed cuts through the dredged material berms and the conveyance channels proposed within the primary impact areas will be implemented as described for Alternatives 33 and 39 in Sections 3.4.2 and 3.4.8, respectively.

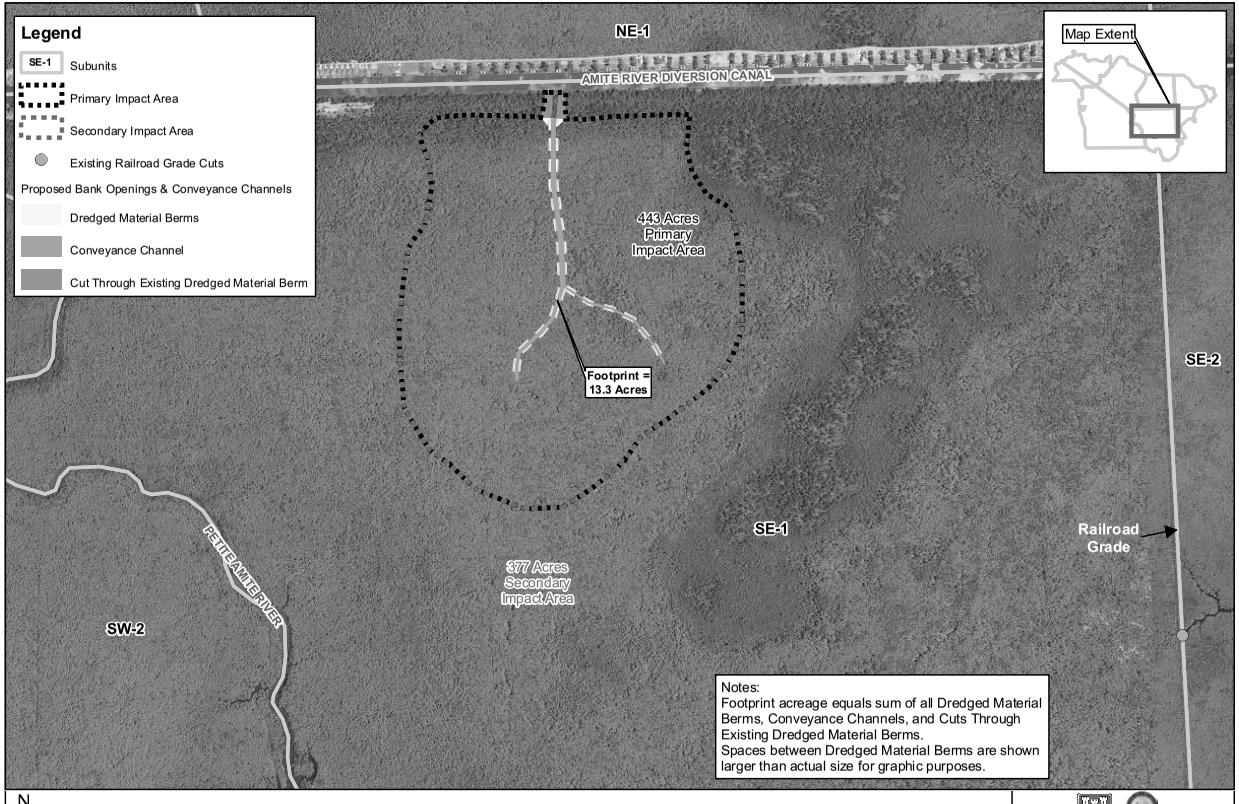
3.4.4 Alternative 35 (SE-1)

Features of Alternative 35 (Figure 3.11) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (2.2 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Initial and secondary vegetative plantings of bottomland hardwood/freshwater swamp tree species on 2.2 acres of the dredged material berms.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

The opening would promote an influx of fresh water, nutrients, and sediments into these areas, which would help flush high salinity waters from the swamp, improve the degraded swamp habitat, and decrease the transition to marsh and open water. Alternative 35 would benefit approximately 820 acres of existing freshwater swamp and create 2.2 acres of upland habitat from dredged material placement. This alternative would address all the project objectives stated in Section 2.4.2.

Descriptions of the proposed cuts through the dredged material berms and the conveyance channels proposed within the primary impact areas will be implemented as described for Alternatives 33 and 39 in Sections 3.4.2 and 3.4.8, respectively.



ALTERNATIVE 35

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.11
Date: December 2009
Scale: 1:20,000
Source: USGS/GEC
Map ID: 27850108-1870

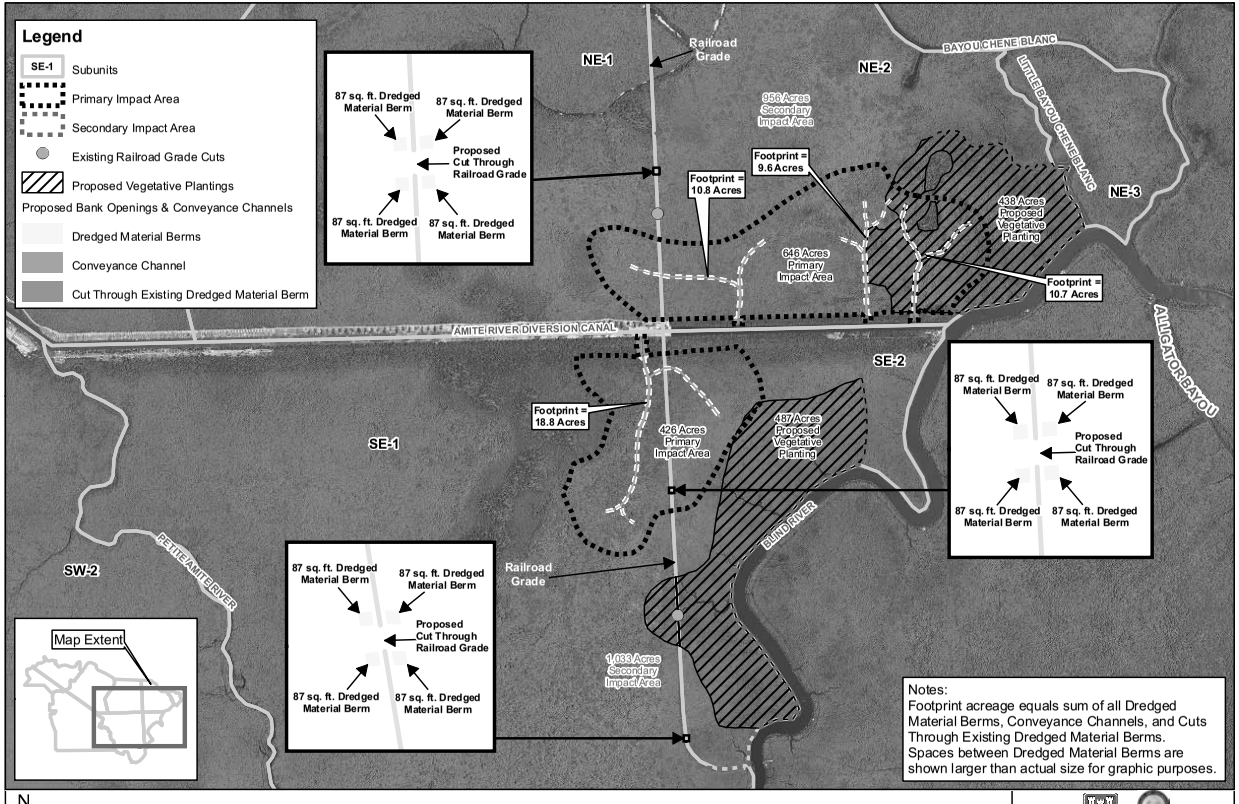
3.4.5 Alternative 36 (NE-1/NE-2, SE-1/SE-2)

Features of Alternative 36 (Figure 3.12: Combinations of Alternatives 33 and 34) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2, and the ARDC.
- One dredged material bank opening and one bifurcated conveyance channels in the south bank of the ARDC in SE-1 with the conveyance channels extending through the railroad grade into SE-1 would facilitate hydrologic connectivity between the ARDC, SE-1, and SE-2.
- Dredged material (7.8 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately 2 miles south of the ARDC.
- Initial and secondary vegetative plantings of bottomland hardwood/freshwater swamp tree species on 7.8 acres of the dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 925 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

The openings would restore hydrologic connectivity of the habitats north and south of the ARDC with the ARDC. North of the ARDC, proper drainage of impounded waters in NE-2 would promote the restoration of the degraded swamp and the decreasing of marsh to swamp forest. South of the ARDC, the swamp habitats would benefit from the influx of fresh water, nutrients, and sediments. Alternative 36 would benefit approximately 3,061 acres of existing freshwater swamp, recreate 290 acres of freshwater swamp from freshwater marsh, and create 7.8 acres of upland habitat from dredged material placement. This alternative would address all of the project objectives stated in Section 2.4.2.

Descriptions of the proposed cuts through the dredged material berms and the conveyance channels proposed within the primary impact areas will be implemented as described for Alternatives 33 and 39 in Sections 3.4.2 and 3.4.8, respectively.



ALTERNATIVE 36

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.12
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1871

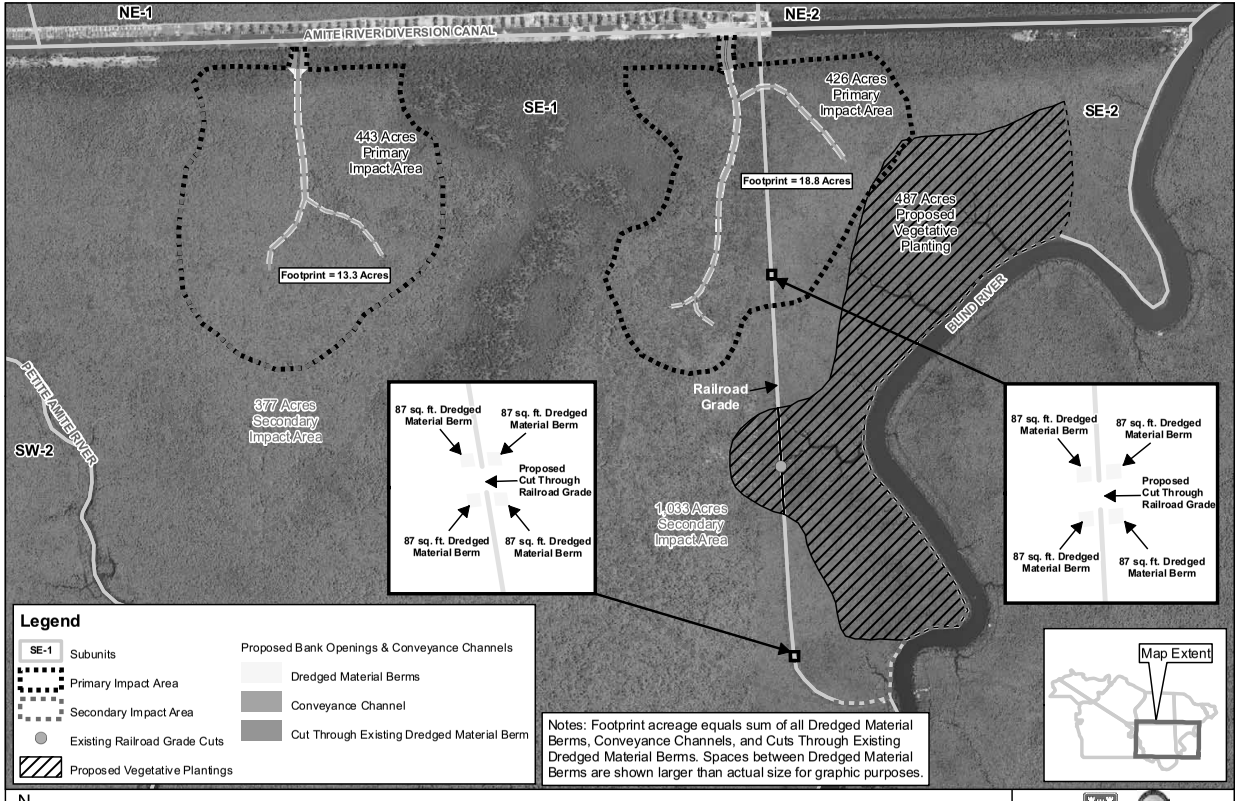
3.4.6 Alternative 37 (SE-1/SE-2, SE-1)

Features of Alternative 37 (Figure 3.13: Combinations of Alternatives 34 and 35) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 would facilitate hydrologic connectivity between the ARDC, SE-1, and SE-2.
- One bank opening and conveyance channels in the south bank of the ARDC in SE-1.
- Two cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles south of the ARDC. The second cut would be approximately 2.0 miles south of the ARDC.
- Dredged material (4.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Initial and secondary vegetative plantings of bottomland hardwood/freshwater swamp tree species on 4.9 acres of dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 487 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

The openings would restore hydrologic connectivity of the area south of the ARDC with the ARDC. Subunits SE-1 and SE-2 would benefit from the influx of fresh water, nutrients, and sediments. This would maintain the swamp forests in SE-1 and improve the degraded swamp forest in the eastern portion of SE-1 and in SE-2, as well as decrease the transition from swamp to marsh to ultimately open water in SE-2. Alternative 37 would benefit approximately 2,279 acres of existing freshwater swamp, recreate 146 acres of freshwater swamp from freshwater marsh, and create 4.9 acres of upland habitat from dredged material placement. This alternative would address all the project objectives stated in Section 2.4.2.

Descriptions of the proposed cuts through the dredged material berms and the conveyance channels proposed within the primary impact areas will be implemented as described for Alternatives 33 and 39 in Sections 3.4.2 and 3.4.8, respectively.



ALTERNATIVE 37

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.13
Date: February 2010
Scale: 1:26,000
Source: USGS/GEC
Map ID: 27850108-1872

3.4.7 Alternative 38 (NE-1/NE-2, SE-1)

Features of Alternative 38 (Figure 3.14: Combinations of Alternatives 33 and 35) include:

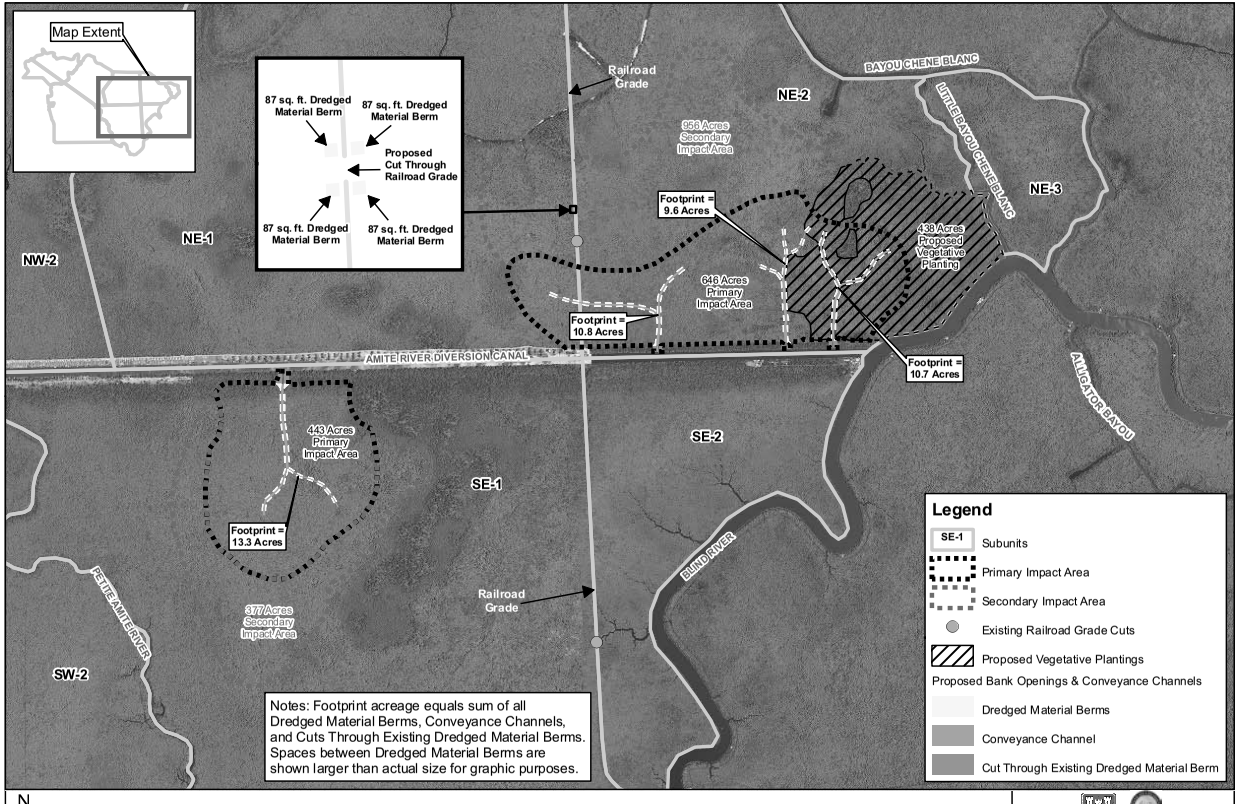
- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One bank opening and conveyance channels in the south bank of the ARDC in SE-1.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Dredged material (7.2 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Initial and secondary vegetative plantings of bottomland hardwood/freshwater swamp tree species on 7.2 acres of dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

Implementation of this alternative would restore the hydrologic connectivity of NE-1, NE-2, and SE-1 with the ARDC. Within NE-1 and NE-2, the benefits would consist of proper drainage of impounded waters from NE-2, improvement of the degraded swamp, and decreasing the transition from swamp to march to ultimately open water. The cut in the south bank of ARDC would restore the hydrologic connectivity of the ARDC with SE-1 and help to maintain the health of the swamp forest along the western portion of SE-1. Alternative 38 would benefit approximately 2,422 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 7.2 acres of upland habitat from dredged material placement. This alternative would address all of the project objectives stated in Section 2.4.2.

Descriptions of the proposed cuts through the dredged material berms and the conveyance channels proposed within the primary impact areas will be implemented as described for Alternatives 33 and 39 in Sections 3.4.2 and 3.4.8, respectively.

3.4.8 Alternative 39 (NE-1/NE-2, SE-1/SE-2 – All Subunits Combined)

Features of Alternative 39 (Figure 3.15: Combinations of Alternatives 33, 34 and 35) include:

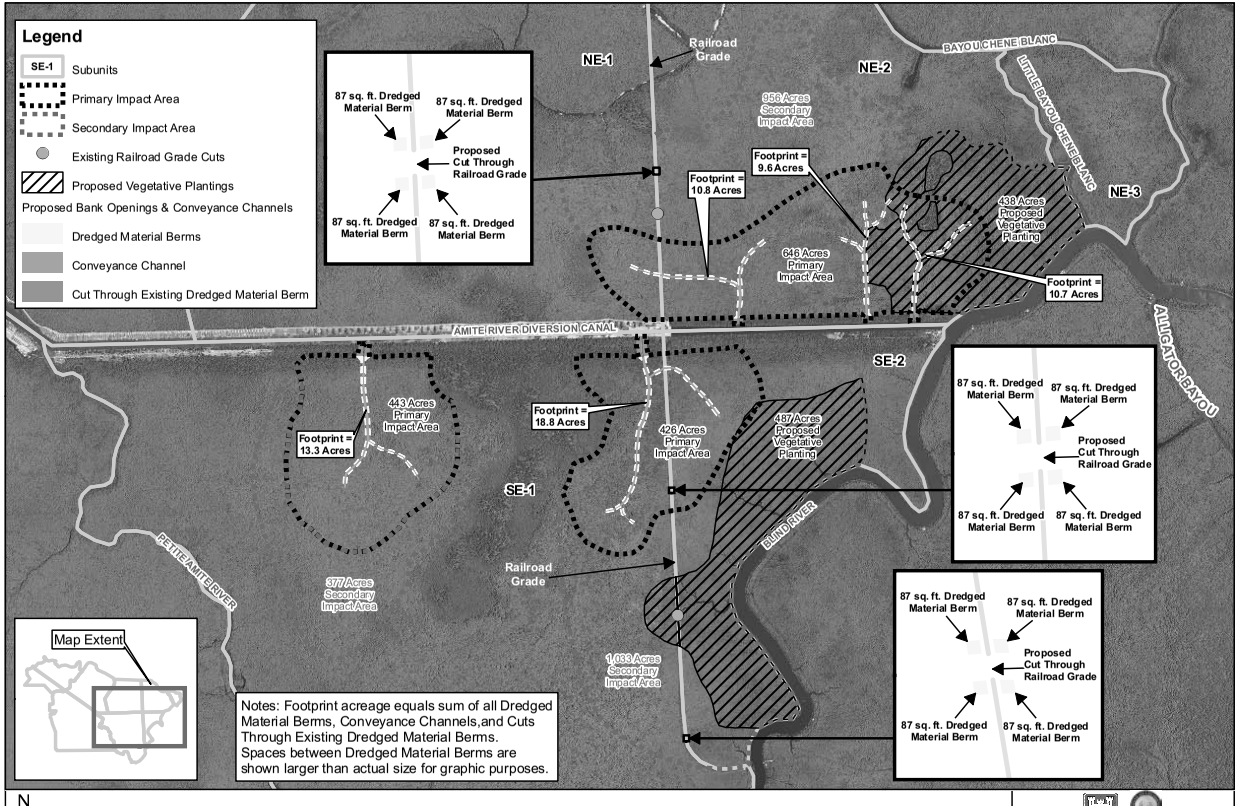


ALTERNATIVE 38

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.14
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1873



ALTERNATIVE 39

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.15
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1874

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
  One opening and one conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (9.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately two miles south of the ARDC.
- Initial and secondary vegetative plantings of bottomland hardwood/ freshwater swamp tree species on 9.9 acres of dredged material berms.
- Initial and secondary vegetative plantings of freshwater swamp tree species within 925 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

Implementation of this alternative would restore the hydrologic connectivity between NE-1, NE-2, SE-1, and SE-2 with the ARDC. This alternative would provide the maximum effort to restore hydrologic connectivity of the wetlands to the ARDC. Alternative 39 would benefit approximately 3,881 acres of existing freshwater swamp, recreate 290 acres of freshwater swamp from freshwater marsh, and create 9.9 acres of upland habitat from dredged material placement. This alternative would address all of the project objectives stated in Section 2.4.2.

All excavation to take place for the cuts through the dredged material berms, as well as for the conveyance channels through the swamp, would be based on four design cross-sections (Figures 3.5 through 3.8). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The benches are 25-foot wide flat areas, located above the average water level, on both sides of the conveyance channel. These benches will be included in the portions of the conveyance channel to be cut through the existing dredged material berms. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be

placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 3.5 gives specific quantities and areas associated with the construction of the final array of alternatives.

3.5 COMPARISON OF ALTERNATIVE PLANS

Of the seven alternatives that make up the final array, three are individual alternatives, while the other four are combinations of these three. The effects of the alternatives within the final array were evaluated against the No Action alternative (FWOP condition) in order to determine their overall impact over the 50-year period of analysis (2012 - 2062) of the project. Alternatives were then compared to each other (see Table 3.15). This includes environmental impacts to significant resources, WVA benefits, cost and contributions to project goals, planning objectives and constraints, contributions to the Federal objective, and the Principles and Guidelines (P&G)'s four evaluation criteria (completeness, effectiveness, efficiency and acceptability). A comparison of the features included in each alternative within the final array is found in Table 3.6.

Table 3.6. Comparison of Final Array of Alternatives

Alternative	North Bank Openings	South Bank Openings	Additional Railroad Grade Openings	Berm Plantings (Acres)	Swamp Plantings (Acres)
33	3	0	1	5.0	438
34	0	1	2	2.7	487
35	0	1	0	2.2	0
36	3	1	3	7.8	925
37	0	2	2	4.9	487
38	3	1	1	7.2	438
39	3	2	3	9.9	925

3.5.1 Cost Estimates for the Final Array

As part of the further development of the remaining alternatives, preliminary construction costs were developed to use in the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) analysis. These costs are listed in Table 3.7. While the measures and alternatives recommended for the areas north and south of the ARDC are independent of each other, cost savings are obtained by combining the areas into one alternative (e.g., Alternative 39). These savings are represented by the reductions in the various mobilization and demobilization costs incurred through

Table 3.7. Summary of Costs Estimates for the Final Array

Item	Alt. 33	Alt. 34	Alt. 35	Alt. 36	Alt. 37	Alt. 38	Alt. 39
Mob/Demob	$250,000	$150,000	$150,000	$300,000	$200,000	$300,000	$350,000
Earthwork	$462,000	$332,000	$262,000	$788,000	$583,000	$698,000	$1,050,000
Erosion Protection	$46,000	$23,000	$23,000	$69,000	$45,000	$69,000	$92,000
Vegetative Plantings	$819,000	$906,000	$6,000	$1,720,000	$909,000	$822,000	$1,730,000
Surveying	$54,000	$22,000	$22,000	$70,000	$70,000	$70,000	$86,000
Markups	$631,000	$564,000	$176,000	$1,152,000	$695,000	$756,000	$1,289,000
Planning Eng. & Design	$189,000	$169,000	$53,000	$346,000	$209,000	$227,000	$387,000
Construction Management	$110,000	$99,000	$31,000	$202,000	$122,000	$132,000	$226,000
Total Construction Costs	$2,560,000	$2,270,000	$720,000	$4,650,000	$2,830,000	$3,070,000	$5,210,000
(25% Contingency)	$640,000	$568,000	$180,000	$1,160,000	$708,000	$768,000	$1,300,000
Real Estate	$136,000	$144,000	$62,000	$259,000	$185,000	$178,000	$301,000
Total First Costs*	$3,340,000	$2,980,000	$962,000	$6,070,000	$3,720,000	$4,020,000	$6,810,000
Interest During Construction**	$440,000	$390,000	$126,000	$797,000	$489,000	$528,000	$894,000
Total Construction Cost	$3,780,000	3,370,000	$1,090,000	$6,870,000	$4,210,000	$4,550,000	$7,700,000
Annual OMRR&R Costs	$10,000	$7,000	$7,000	$11,000	$8,000	$11,000	$12,000
Average Annual Costs**	$197,000	$174,000	$61,000	$351,000	$217,000	$236,000	$394,000

*First Quarter 2010 Dollars; ** Average annual costs were determined over the six-year construction period with a discount rate of 4.375 percent; Costs presented are preliminary costs used for planning purposes only and do not represent a fully funded cost estimate.

the implementation of Alternatives 33, 34, and 35, separately. Average annual costs were determined over the six-year construction period with a discount rate of 4.375 percent. The rationale and assumptions used for the development of unit costs and all cost estimates are described in Appendix L.

3.5.2 Wetland Value Assessment Model

WVA models are ecological benefit models designed to evaluate the existing, FWOP, and FWP condition. The CWPPRA WVA Swamp model was chosen for this study area over the Fresh Marsh model, even though portions of the study area have less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a freshwater swamp than a freshwater marsh. The WVA produced Average Annual Habitat Units (AAHUs), a measure of change, for the 50-year period of analysis when comparing the FWP to the FWOP. The Habitat Suitability Index (HSI) is a unit less number bounded by 0 and 1 where 0 represents no habitat and 1 represents optimum habitat. The HSI for a particular area is multiplied by the size of the area for which the HSI was calculated to create the Habitat Unit (HU) value (HU = HSI x size of habitat). AAHUs are calculated by dividing the total number of HUs gained or lost as a result of a proposed action by the period of analysis. Performance measures and targets for the benefits to be achieved are defined in the Adaptive Management Plan in Appendix I.

The WVA calculates the benefits (FWP as compared to the FWOP) for years 0, 1, 10, 25, and 50. The habitat units for each from year 1 to year 50 are calculated. The cumulative habitat units generated for the 50 year period of analysis divided by 50 will determine the AAHU. The 50-year period of analysis is from 2012–2062. Thus the WVA accounts for tree growth and the timing for ecological restoration.

For example, if the net change between the FWOP and FWP is a +0.2 over 100 acres over the 50-year period of evaluation, then that alternative would produce 20 AAHUs of ecological benefit. The model is based upon Habitat Suitability Indices (HSIs) that are developed by evaluating several variables at the site and predicting the future changes, with and without the project. For the freshwater swamp model, variables include stand structure, stand maturity, water regime, and mean high salinity during the growing season. For the bottomland hardwoods model, variables include tree species composition, stand maturity, understory/midstory, size of contiguous forested area, suitability and traversability of surrounding land uses, and disturbance.

Details concerning the professional judgment and model-generated input data utilized in the WVA model are included in the WVA Project Information Sheet, found in Appendix K of this report. The WVA Suitability Index graphs were developed according to the following assumptions:

Variable V_1 - Stand structure. Most swamp tree species do not produce hard mast; consequently, wildlife foods predominantly consist of soft mast, other edible seeds, invertebrates, and vegetation. Because most swamp tree species produce some soft mast or other edible seeds, the actual tree species composition is not usually a limiting factor. More limiting is the presence of stand structure to provide resting, foraging, breeding, nesting, and nursery habitat and the medium for invertebrate production. This medium can exist as herbaceous vegetation, scrub-shrub/midstory cover, or overstory canopy and preferably as a combination of all three.

This variable assigns the lowest suitability to sites with a limited amount of all three stand structure components, the highest suitability to sites with a significant amount of all three stand structure components, and mid-range suitability to various combinations when one or two stand structure components are present.

Variable V_2 - Stand maturity. Because of man's historical conversion of swamp, the loss of swamp to saltwater intrusion, historical and ongoing timber harvesting, and a reduced tree growth rate in the subsiding coastal zone, swamps with mature sizeable trees are a unique but ecologically important feature. Older trees provide important wildlife requisites such as snags and nesting cavities and the medium for invertebrate production. Additionally, as the stronger trees establish themselves in the canopy, weaker trees are out-competed and eventually die, forming additional snags and downed treetops that would not be present in younger stands. The suitability graph for this variable assumes that snags, cavities, downed treetops, and invertebrate production are present in suitable amounts when the average diameter-at-breast height (DBH) of canopy-dominant and canopy-codominant trees is above 16 inches for baldcypress and above 12 inches for tupelogum and other species. Therefore, stands with those characteristics are considered optimal for this variable (SI = 1.0).

Another important consideration for this variable is stand density, measured in terms of basal area. A scenario sometimes encountered in mature swamp ecosystems is an overstory consisting of a very few, widely-scattered, mature baldcypress. If stand density was not considered, and average DBH only, then those stands would receive a high SI for this variable without providing many of the important habitat components of a mature swamp ecosystem, specifically a suitable number of trees for nesting, foraging, and other habitat functions. Therefore, the SI for this variable is dependent on average DBH and basal area which is used as a measure of stand density.

Variable V_3 - Water regime. This variable considers the duration and amount of water flow/exchange. Four flow/exchange and four flooding duration categories are described to characterize the water regime. The optimal water regime is assumed to be seasonal flooding with abundant and consistent riverine/tidal input and water

flow-through (SI=1.0). Seasonal flooding with periodic drying cycles is assumed to contribute to increased nutrient cycling (primarily through oxidation and decomposition of accumulated detritus), increased vertical structure complexity (due to growth of other plants on the swamp floor), and increased recruitment of dominant overstory trees. In addition, abundant and consistent input and water flow-through is optimal, because under that regime the full functions and values of a swamp in providing fish and wildlife habitat are assumed to be maximized. Temporary flooding is also assumed to be desirable. Habitat suitability is assumed to decrease as water exchange between the swamp and adjacent systems is reduced. The combination of permanently flooded conditions and no water exchange (e.g., an impounded swamp where the only water input is through rainfall and the only water loss is through evapotranspiration and ground seepage) is assumed to be the least desirable (SI=0.1). Those conditions can produce poor water quality during warm weather, reducing fish use and crawfish production.

Variable V_4 - Mean high salinity during the growing season. Mean high salinity during the growing season (March 1 to October 31) is defined as the average of the upper 33 percent of salinity measurements taken during the specified period of record. Although baldcypress is able to tolerate higher salinities than other swamp species, species such as tupelogum and many herbaceous species are salinity-sensitive. Optimal conditions are assumed to occur at mean high salinities less than 1.0 ppt. Habitat suitability is assumed to decrease rapidly at mean high salinities in excess of 1.0 ppt.

WVA Benefits. The benefits of the alternatives are directly linked to increases in hydrologic exchange between the ARDC and the swamp (Figure 3.16). The critical issue for the ecosystem restoration is to restore the connectivity to and from the swamp. The H&H Model was used to assist in assigning values to V3, based on the expected days of drying associated with each alternative. This connectivity would not only create an exchange of freshwater, nutrients, and sediments, but it would also alleviate the impounding that is occurring in NE-1 and NE-2. The WVA analysis (Appendix K) used the information from the H&H modeling, to determine the values to be used for the water regime variable. Table 3.8 depicts the net habitat units (HUs) and the annualized cost associated with the No-Action alternative and the final array, over the 50-year period of analysis. Estimates of accretion are based upon work by Shaffer *et al*. 2006 and 2009. In areas of sediment poor, but sufficient freshwater and nutrients, swamps were able to develop accretions to balance RSLR. This information was incorporated in the evaluation of the FWP for V3.

The WVA analyses were run for each alternative within the final array to determine the quantitative benefits of each alternative, including the areas impacted by the construction of the bank openings, conveyance channels, and dredged material placement. This analysis took into account the fact that any future development of

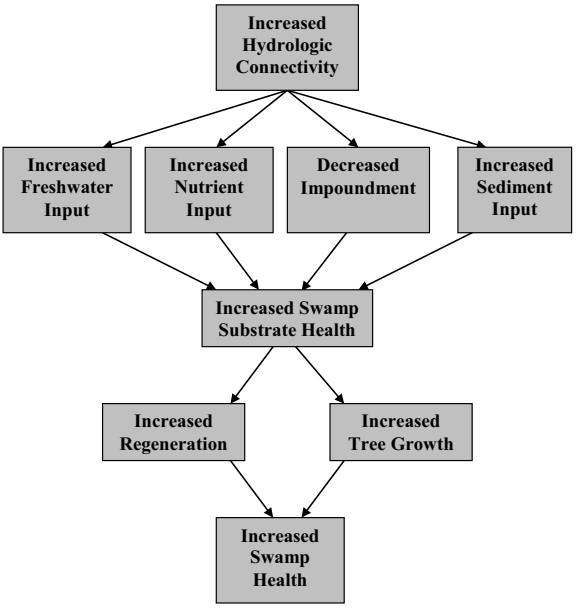


Figure 3.16. Project Benefits

Table 3.8. Summary of WVA Benefits of Final Array

Alternative No.	Total Benefits (HUs)	Annualized Benefits (AAHUs)
No Action	0	0
35	16,680	334
34	29,428	589
33	33,973	679
37	46,109	922
38	50,653	1,013
36	63,402	1,268
39	80,081	1,602

the dredged material berms, within the areas of impact, would have no effect on the benefits generated by the final array. The WVA initial analysis was completed on the primary and secondary impact areas for all alternatives for the low RSLR scenario (Table 3.9, Figures 3.4 and 3.10 - 3.15). The WVA analysis was also run on the intermediate and high RSLR scenarios for the NER and Recommended Plan. The concept of RSLR was introduced in Sections 2.3.3.3 and 2.3.5.1 of the report. Based on the fact that all alternatives within the final array implement similar features, in areas with very little fluctuation in land elevations, it was determined that RSLR would have the same effect on water levels for all alternatives in the final array and little to no variance in water levels would occur.

Table 3.9 Computed Exchange Channel Flows with RSLR

With project with no RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6,330	5,298	4,812	4,368	4,035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6,874	7,160	3,392	3,696	4,088
% time of outflow	77%	78%	71%	72%	72%
With Project with 50 years of Low rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	23,175	20,734	14,522	13,503	12,903
% time of inflow	35%	34%	54%	53%	52%
Volume outflow (ac-ft/yr)	32,635	35,202	7,291	8,187	8,894
% time of outflow	65%	66%	46%	47%	48%

The primary and secondary impact areas for the final array of alternatives were developed after examining existing conveyance channels found within the study area. These channels are considered to be in a state of hydrologic equilibrium due to the lack of sediment buildup observed, when compared to other channels found within the same general area. The benefit areas for the proposed conveyance channels were developed by observing the dimensions and configurations of the drainage areas found along these existing channels.

The primary impact area would have more flow exchange and therefore more sediments and nutrients than the secondary impact area. The volume of water, which transports sediments and nutrients, is dependent on the duration of high stages in the ARDC. During the short duration of high stages in the ARDC, the benefits may be limited to the primary impact area. During normal hydrologic cycles, the primary impact area would receive a higher flow exchange than the secondary impact area. Table 3.10 and Figures 3.17 through 3.23 depict the net

habitat units (HUs) obtained by the No-Action alternative and the final array over the 50-year period of analysis, and Figure 3.24 depicts the net benefits gained. It is apparent from the data that a net of 200 to 900 HUs is obtained for each of the seven alternatives. It is also apparent that each alternative obtains the maximum level of benefits at around year 25 and maintains these levels through the remaining 25 years of the period of analysis. This shows that all alternatives within the final array provide sustainable benefits. Maps depicting the impact acreages utilized by the WVA model for each habitat type within the study and impact areas are found in Appendix K.

Table 3.10. Final Array Benefits

Benefits Over the 50-Year Period of Analysis (HUs)						
Alternative		Year				
		0	1	10	25	50
33	No-Action	757	762	636	562	518
	With Project	757	889	1047	1390	1466
	Net	0	127	410	828	948
34	No-Action	607	611	545	506	461
	With Project	607	697	875	1228	1308
	Net	0	85	330	723	847
35	No-Action	471	474	410	358	291
	With Project	471	547	611	756	766
	Net	0	73	201	398	476
36	No-Action	1364	1373	1182	1068	979
	With Project	1364	1586	1922	2618	2774
	Net	0	213	740	1551	1795
37	No-Action	1078	1085	955	863	751
	With Project	1078	1243	1486	1984	2074
	Net	0	158	531	1121	1323
38	No-Action	1228	1236	1047	919	809
	With Project	1228	1436	1657	2146	2232
	Net	0	200	611	1226	1424
39	No-Action	1835	1843	1589	1423	1268
	With Project	1835	2137	2535	3377	3542
	Net	0	294	946	1954	2273

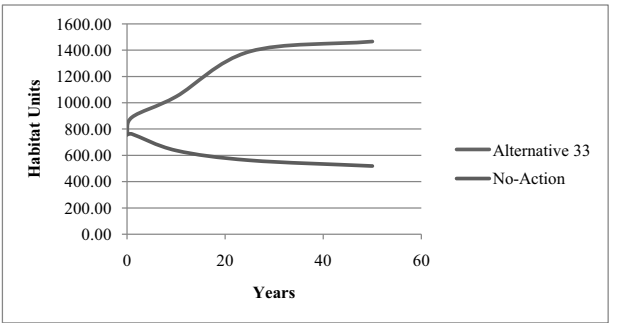


Figure 3.17. Comparison of Benefits for Final Array, Alternative 33

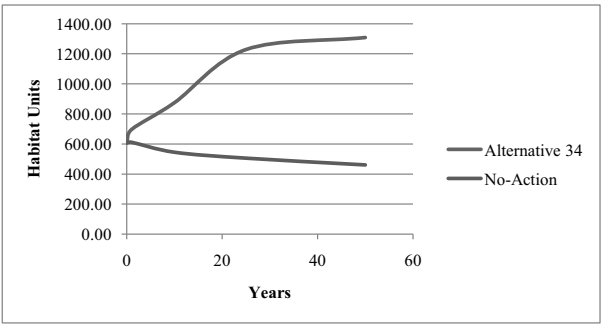


Figure 3.18. Comparison of Benefits for Final Array, Alternative 34

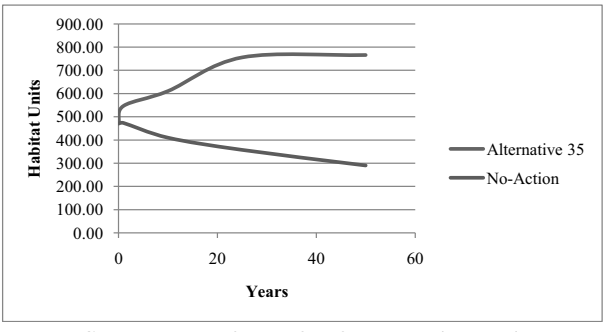


Figure 3.19. Comparison of Benefits for Final Array, Alternative 35

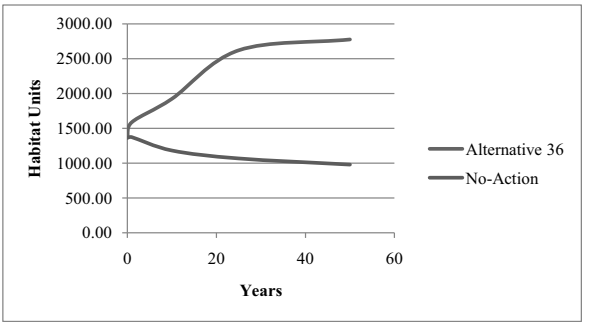


Figure 3.20. Comparison of Benefits for Final Array, Alternative 36

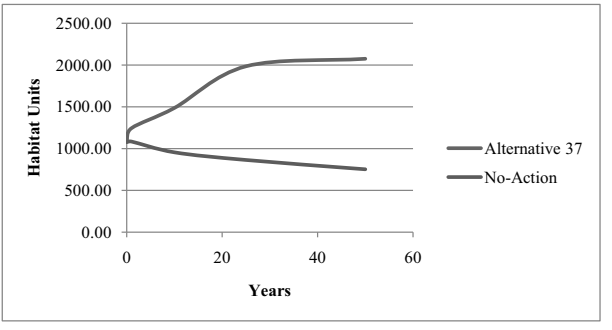


Figure 3.21. Comparison of Benefits for Final Array, Alternative 37

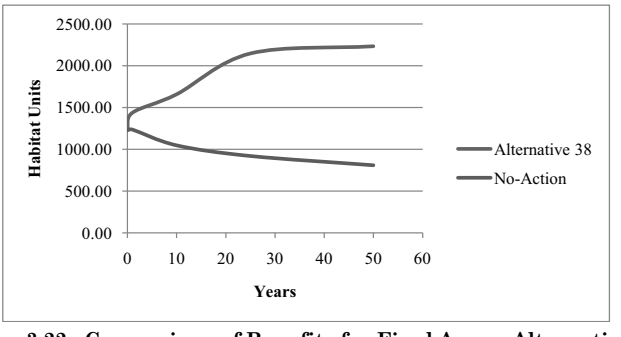


Figure 3.22. Comparison of Benefits for Final Array, Alternative 38

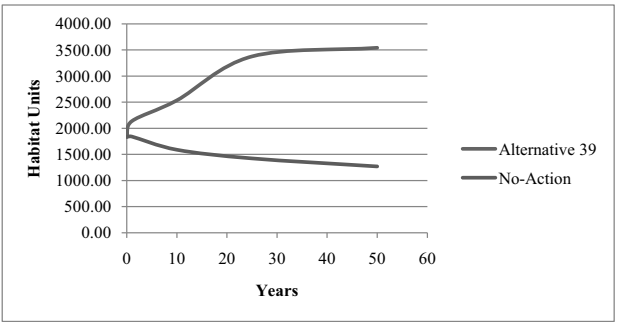


Figure 3.23. Comparison of Benefits for Final Array, Alternative 39

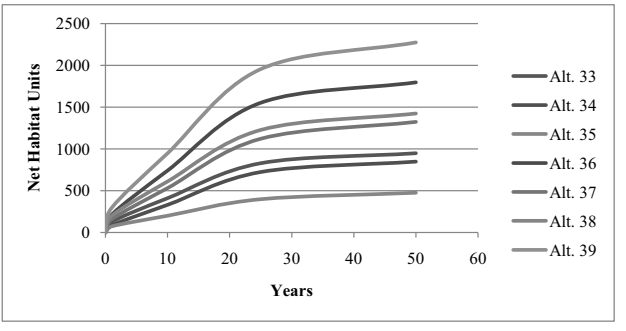


Figure 3.24. Net Benefits Gained by Final Array

Additionally, the H&H model shows that under the low RSLR estimate for the No-Action alternative, the areas of impact would be permanently inundated in 14 years. Without considering the impacts of biomass accretion, under the Future With Project conditions, the area of impacts would not be considered permanently inundated for 40 years. The introduction of freshwater, nutrients, and sediments, even under permanent inundation, would still improve that swamp habitat (Gary Shaffer, personal communication, October 2009). Low oxygen and reducing conditions restrict tree growth in inundated conditions. However, improved flow would increase oxygen and improve tree vigor, even in fully inundated conditions (Gary Shaffer, personal communication, October 2009). Therefore, as long as hydrologic connectivity is achieved and regeneration is established, benefits would be realized under permanently inundated conditions and project success would not be compromised. The plateaus depicted in Figures 3.17 through 3.24 indicate that a

state of natural equilibrium is obtained over the 50-year period of analysis. This state of equilibrium is indicative of a system that would continue to exhibit ecological benefits despite the fact that it is a permanently inundated system as long as hydrologic connectivity is maintained. This is why it is critical to the success of this project to implement vegetative plantings in the portions of the study area which do not exhibit canopy cover and adequate stand densities, before permanent inundation occurs.

The increase in drying days, which would occur for the first 40 years of the period of analysis, would allow the substrate to oxidize, release bound nutrients, and allow for substrate compaction. The benefits from the drying days would reverse the conversion of swamp to marsh and open water (Shaffer *et al*., 2009, Bernard Wood personal communication, July 2009). Accretion may also play a role in reducing the effects of RSLR. It has been estimated that a net accretion of 8mm/year could be achieved within the healthy swamp habitat found in the study area (Bernard Wood, unpublished data, 2005 through 2009).

After comparing the final array of alternatives, based on the applicable criteria including benefits and impacts, the PDT ranked the alternatives in the order depicted in Table 3.11. These are rankings based on restoration opportunities provided by each alternative and do not take into account project constraints such as funding limitations. The rationale for selection of the Recommended Plan and is further discussed in Sections 3.7 and 3.7.11.1 of this report.

Table 3.11. Ranking of Final Array

Rank	Alternative	Reasoning
1	39	Produces the most benefits of any alternative and addresses the two most critical areas, plus SE-1 and NE-1.
2	36	Produces the second-most benefits of any alternative and addresses the most critical areas, plus SE-1 and NE-1.
3	38	Produces benefits within the most critical areas, plus SE-1. SE-1 is not considered as degraded as SE-2.
4	33	Includes the most critical area and benefits to NE-1.
5	37	Includes benefits for SE-1 and SE-2. Does not include the most critical area, NE-2.
6	34	Includes benefits in a smaller portion of SE-1 and SE-2. Does not include the most critical area, NE-2.
7	35	Includes benefits in SE-1 only. Does not include the most critical areas.
8	No-Action	Does not produce benefits within the study area.

WVA Model Certification. The WVA model is completing model certification in accordance with EC 1105-2-407, May 2005 Planning Models Improvement Program. The model has undergone external review which is documented in the July 8, 2009, Draft Model Certification Review Report for the Wetland Value Assessment Models prepared by the Battelle Memorial Institute for the US Army Corps of Engineers, Ecosystem Planning Center of Expertise. The responses to the Battelle review have been submitted to the ECO-PCX. The ECO-PCX has reviewed the revisions and will forward a recommendation to certify the model for use in the LCA projects. Since the WVA was still in the process of being certified, the projects using the WVA model were required to respond to specific comments related to the ongoing certification process and the use of WVA on the specific project. The specific comments and responses for the WVA as it relates to the LCA ARDC Modification project can be found in Appendix K. Based on satisfactory responses to these comments Planning Center of Expertise for Ecosystem Restoration has cleared the WVA model for use in evaluating the alternatives considered in this report.

Hydraulic Analysis. The USACE Engineering Center River Analysis System (HEC-RAS) program was used to simulate FWOP and FWP conditions. The HEC-RAS models are used to simulate flow exchange and flood duration for the proposed actions. The results of the HEC-RAS model runs were then used to support the WVA model. Specifically, the model results were used to quantify flow/exchange and flooding duration (Variable V_3) in the WVA calculations. The HEC-RAS model was also used to assist in the evaluation of the impacts of RSLR.

WVA models are ecological benefit models designed to evaluate the project benefits associated with a proposed action. The benefits of the alternatives are linked to the flow exchange between the ARDC and the adjacent swamp (Variable V3). The HEC-RAS program does not estimate project benefits nor predict project success. A HEC-RAS model is a surface water model used to estimate stage and discharge relationships.

3.5.3 Institute of Water Resources Planning Suite Analysis

Each alternative within the final array was evaluated through a cost-effectiveness and incremental cost analysis (CE/ICA) by utilizing the Institute of Water Resources (IWR)-Planning Suite software. The 50-year evaluation period for the ARDC modification project was used. This software utilizes the annualized output from the WVA Model (AAHUs) and the annualized costs of each alternative to determine which proposed actions are deemed cost effective. Of the actions considered cost-effective by this analysis, some are given the designation of being considered a Best-Buy, meaning the proposed action provides the greatest increase in output for the least increases in cost. By default, the No Action alternative and the largest cost effective alternative (i.e., the cost effective alternative with the greatest annualized ecosystem outputs or benefits) are considered to be Best Buy

alternatives. Any of the proposed actions that are found to be cost-effective during this analysis may be considered for selection as the TSP and ultimately the Recommended Plan. The information utilized by the software is listed in Table 3.12. However, according to guidance from ER 1105-2-100, E-41 c., rarely will the NER plan not be among the best buy plans. The reason for such a selection should be clearly explained in the supporting documentation as well as the potential implications for cost sharing. The background information utilized for the CE/ICA analysis is found in Appendix K.

Table 3.12. Alternatives Costs and Benefits

Alternative	Acres of Benefit	AAHUs	Total Construction Cost	Annualized Cost**	Annualized Cost/AAHU
35*	820	334	$1,090,000	$61,000	$180
38*	2,422	1,013	$4,550,000	$236,000	$230
37	2,279	922	$4,210,000	$217,000	$240
39*	3,881	1,602	$7,700,000	$394,000	$250
36	3,061	1,268	$6,870,000	$351,000	$280
33	1,602	679	$3,780,000	$197,000	$290
34	1,459	589	$3,360,000	$174,000	$300

* Denotes Best Buy Plan

**Average annual costs were determined over the six-year construction period with a discount rate of 4.375 percent. Costs represent preliminary costs for planning purposes only and do not represent a fully funded cost estimate.

The results of the IWR Planning Suite analysis are found in Table 3.13 and Figures 3.25 and 3.26. According to the analysis, all proposed actions were found to be cost-effective. Three actions plus the No-Action were also designated as Best Buys. Based on the results of the IWR Planning Suite analysis, it was determined that all of the proposed actions within the final array of alternatives could be considered for selection as the TSP and that no alternatives were eliminated from consideration. The justification for the selection of the TSP/ Recommended Plan is provided in Section 3.7.11.1.

Table 3.13. IWR-PLAN Results

Alternative	Annualized Cost	Output (AAHUs)	Cost Effective?
No Action Plan	$0	0	Best Buy
35	$61,000	334	Best Buy
34	$174,000	589	Yes
33	$197,000	679	Yes
37	$217,000	922	Yes
38	$236,000	1013	Best Buy
36	$351,000	1268	Yes
39	$394,000	1602	Best Buy

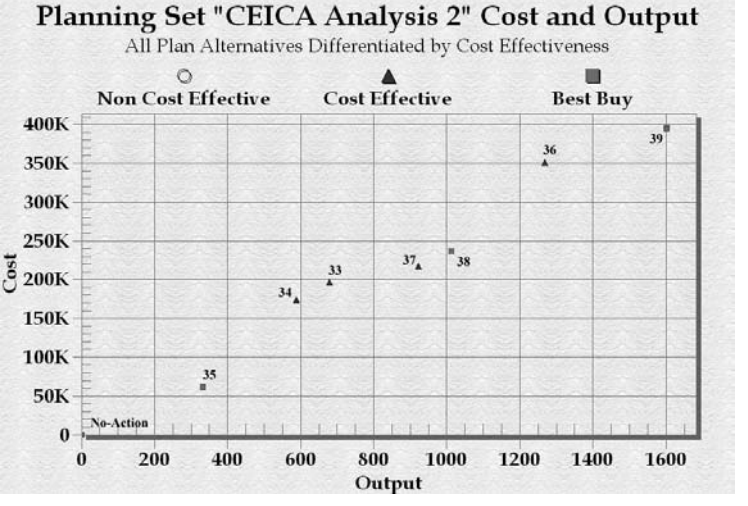


Figure 3.25. Cost versus Output

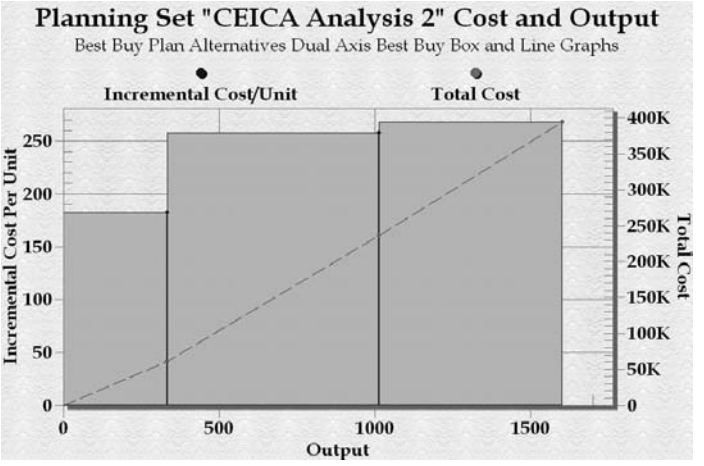


Figure 3.26. IWR Best Buy Comparison

3.5.4 Summary Comparison of Final Array of Alternatives

The conversion of acreages to freshwater marsh and open water for the final array, as previously depicted in Figure 2.2, is summarized in Table 3.14. In addition, a summary comparison of impacts to significant resources for the final array of alternatives is found in Table 3.15. The information presented in both tables, along with each plan's contribution to planning objectives, constraints, and evaluation criteria was used when selecting the National Ecosystem Restoration (NER) plan, along with the Recommended Plan. Table 3.15 represents a summary of the costs, impacts, and quantities associated with the final array of alternatives. Further information regarding these proposed actions and the corresponding impacts may be found throughout Sections 4 and 5 of this report.

Table 3.14. Conversion of Habitat Types (Years to Marsh) for each Alternative

Years to Marsh	Study Area Degradation (Acres)	Benefits Achieved from Final Array (Acres)						
	No-Action	33	34	35	36	37	38	39
Existing Marsh	300	144	146	0	290	146	144	290
10 Years to Marsh	1,723	241	775	0	1,016	775	241	1,016
20 - 3- Years to Marsh	7,979	975	299	542	1,274	841	1,518	1,816
30 - 50 Years to Marsh	8,202	242	239	278	481	517	519	759
Total Acres	**18,204**	**1,602**	**1,459**	**820**	**3,061**	**2,279**	**2,422**	**3,881**
***Benefits (AAHUs)**	**0**	**679**	**589**	**334**	**1,268**	**922**	**1,013**	**1,602**
*** AAHUs calculated for year 50 (2061)**								

3.6 NATIONAL ECOSYSTEM RESTORATION PLAN

The following is the criteria for selecting the NER Plan.

For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. The selected plan must be shown to be cost-effective and justified to achieve the desired level of output. This plan shall be identified as the National Ecosystem Restoration (NER) Plan (ER 1105-2-100).

Based on the results of the WVA modeling, the IWR Planning Suite analysis, and the impacts of alternative plans, Alternative 39 was chosen to be the NER plan. This plan includes all the areas in the final array including the areas with the critical need of restoration (NE-2 and SE-2 have already begun converting to marsh) and additional areas that are expected to need restoration in the next 20 years (SE-1, NE-1). The non-Federal sponsor supports Alternative 39 as the NER plan and believes it represents the long term restoration need for the area. The non-Federal sponsor supports the NER plan; therefore, no separate locally preferred plan (LPP) is identified. The NER plan is also identified as the environmentally preferable plan (EPP) since it maximizes the environmental benefit

3.7 PLAN SELECTION – TENTATIVELY SELECTED PLAN (TSP)/ RECOMMENDED PLAN

The following is the criteria for selection of the TSP and Recommended Plan.

A single alternative plan would be selected for recommendation from among all those that have been considered. It must be shown to be preferable to taking no action (if the No-action alternative is not recommended) or implementing any of the other alternatives considered during the planning process (ER 1105-2-100).

Alternative 33, which addresses the most-highly degraded portion of the study area (NE-2) and provides benefits within NE-1, was chosen as the TSP and was later confirmed as the Recommended Plan. Alternative 33 was chosen based on the WVA modeling results (Tables 3.11 and 3.12), IWR Planning Suite analysis (Table 3.13 and Figures 3.17 and 3.18), and the impacts on significant resources found within the study area (Table 3.15). Alternative 33 is an implementable increment of the NER plan, is within the cost and scope of the WRDA 2007 authorization, has stand-alone utility, and can be justified based on ecosystem restoration benefits. This alternative provides sustainable benefits for the areas of impact with 679 AAHUs. The non-Federal sponsor supports Alternative 33 as the Recommended Plan under the current WRDA 2007 authorization.

A comparison of the NER and the Recommended Plan is shown in Figure 3.27. Development of additional restoration activities within the most highly-degraded areas not currently evaluated as part of the Recommended Plan (Alternative 33) should receive priority. More specifically, primary consideration should be given to improving degradation within SE-2, then SE-1. It should be noted that there are other potential sources for restoration within the study area that may be able to provide an opportunity to build the remaining portions of the NER plan and/or build additional restoration features above the Recommended Plan. The Livingston Parish CIAP project, Hydrologic Restoration in Swamps West of Lake Maurepas, located within the study area received study funding in September 2010 to begin design but has not yet been awarded construction funding. Based on the aforementioned coordination, once the CIAP project is authorized for construction funding, the actions proposed by this project will represent a separate effort from the actions recommended by the LCA ARDC Modification project. To date, no formal request for the use of CIAP funds as a cost share for this project has been made.

A comparison of the costs for the NER plan and the Recommended Plan is shown in Table 3.16. Additionally, the details behind the authorized costs are located in Table 3.17.

3.7.1 Components

Features of the Recommended Plan (Figure 3.4) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.

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Table 3.15. Summary Comparison of Final Array of Alternatives

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
1. PLAN DESCRIPTION		No-Action/Without Project Condition	NE-2, NE-1, 3 cuts ARDC dredged material berm, 1 railroad grade cut, 1 conveyance channel cut, vegetative plantings	SE-2, SE-1, 1 cut ARDC dredged material berm, 2 railroad grade cuts, 1 conveyance channel cut, vegetative plantings	SE-1, 1 cut ARDC dredged material berm	NE-2, SE-2, NE-1, SE-1, 4 cuts ARDC dredged material berm, 3 railroad grade cuts, 2 conveyance channel cuts, vegetative plantings	SE-2, SE-1, 2 cuts ARDC dredged material berm, 2 railroad grade cuts, 1 conveyance channel cut, vegetative plantings	NE-2. SE-1, NE-1, 4 cuts ARDC dredged material berm, 1 railroad grade cut, 1 conveyance channel cut, vegetative plantings	NE-2, SE-2, NE-1, SE-1, 5 cuts ARDC, dredged material berm, 3 railroad grade cuts, 2 conveyance channel cuts, vegetative plantings
2. IMPACT ASSESSMENT									
	A. NER								
	1) Total Project Cost: *preliminary cost - planning only*	$0	$3,780,000	$3,370,000	$1,090,000	$6,870,000	$4,210,000	$4,550,000	$7,700,000
	2) Annual Cost (not fully funded)	$0	$196,686	$173,671	$60,956	$351,365	$217,220	$236,293	$394,171
	3) Total Benefits (CHU)	0	33,937	29,429	16,680	63,402	46,109	50,653	80,082
	4) Annual Net Benefits (AAHU)	0	679	589	334	1,268	922	1,013	1,602
	5) Cost Effective (yes/no/best buy)	Best Buy	Yes	Yes	Best Buy	Yes	Yes	Best Buy	Best Buy
	B. Environmental Resources								
	1) Soils and Water Bottoms: Soils	Conversion of 18,204 acres of Barbary, Fausse, and Maurepas swamp soils experience nearly continuous waterlogging, subsidence and reduction in organic components.	Net total of 1,602 acres of wetland soils restored and nourished; 2.6 acres ARDC berm soils and 28.6 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 1,459 acres of wetland soils restored and nourished; 3.4 acres ARDC berm soils and 15.4 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 820 acres of wetland soils restored and nourished; 2.4 acres ARDC berm soils and 10.9 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 3,061 acres of wetland soils restored and nourished; 6.0 acres ARDC berm soils and 44.0 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 2,279 acres of wetland soils restored and nourished; 5.8 acres ARDC berm soils and 26.3 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 2,422 acres of wetland soils restored and nourished; 5.0 acres ARDC berm soils and 39.5 acres existing swamp soils removed to construct bottomland hardwood "islands."	Net total of 3,881 acres of wetland soils restored and nourished; 8.4 acres ARDC berm soils and 54.9 acres existing swamp soils removed to construct bottomland hardwood "islands."
	2) Soils and Water Bottoms: Water Bottoms	Swamp water bottoms remain isolated from hydrologic connections; swamp water bottoms convert to open water; decreased nutrients and detritus from decomposing swamp vegetation	18.6 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates.	10.5 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates	7.2 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections result in increased detritus and healthier benthic substrates	29.1 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates	17.7 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates	25.8 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates	36.3 acres existing swamp water bottoms dredged to create drainage channels; increased hydrologic connections and tree plantings result in increased detritus and healthier benthic substrates

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	3) Hydrology: Flow and Water Levels	Continued hydrologic isolation and impoundment resulting in reduced flows into and out of the SA; water levels static but steadily increase due to continued hydrologic barriers and projected sea level rise.	Connected hydrology increases flows into and out of 1,602 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 1,459 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 820 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 3,061 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 2,279 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 2,422 acres swamp; water levels fluctuate in response to ARDC and sea level rises.	Connected hydrology increases flows into and out of 3,881 acres swamp; water levels fluctuate in response to ARDC and sea level rises.
	4) Hydrology: Sediment	Continued lack of sediment inputs into SA due to hydrologic isolation and impoundment.	Connected hydrology increases potential for sediment inputs into 1,602 acres swamp.	Connected hydrology increases potential for sediment inputs into 1,459 acres swamp.	Connected hydrology increases potential for sediment inputs into 820 acres swamp.	Connected hydrology increases potential for sediment inputs into 3,061 acres swamp.	Connected hydrology increases potential for sediment inputs into 2,279 acres swamp.	Connected hydrology increases potential for sediment inputs into 2,422 acres swamp.	Connected hydrology increases potential for sediment inputs into 3,881 acres
	5) Hydrology: Water Use and Supply	Continued increase in water use and supply demands; conversion of swamp habitat to open water reduces water purification function of wetlands.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 1,602 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 1,459 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 820 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 3,061 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 2,279 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 2,422 acres swamp.	Continued increase in water use and supply demands; connected hydrology improves water purification function over 3,881 acres swamp.
	6) Hydrology: Groundwater	Nearby human populations and industry continue to increase resulting in increased groundwater demands and decreased groundwater resources. Continually degrading swamp habitat no longer functions as an effective natural water quality filtration system to shallow aquifers.	Restoration of 1,602 acres swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 1,459 acres swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 820 acres swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 3,061 swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 2,279 acres swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 2,422 acres swamp acts as natural water quality filtration system to the shallow aquifers.	Restoration of 3,881 acres swamp acts as natural water quality filtration system to the shallow aquifers.
	7) Water Quality	Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water reduces natural water quality. Continued discharge of untreated stormwater runoff from nearby populated areas into the SA.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 1,602 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 1,459 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 820 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 3,061 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 2,279 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 2,422 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.	Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen) during construction. Water quality improves over 3,881 acres of swamp habitat due to increased connectivity as well as absorption and filtering of the untreated stormwater runoff.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	8) Water Quality: Salinity	Continued impoundment results in longer residence time of higher-salinity water. This results in absorption of salinity into swamp soils, continuing the degradation of freshwater swamp and bottomland hardwood vegetation. Salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 1,602 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 1,459 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 820 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 3,061 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 2,279 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 2,422 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.	Restored hydrologic connectivity to 3,881 acres reduces impoundment of higher salinity waters; salinities would have temporary spikes, but flushing would lower salinity overall. At the same time, salinities may also increase due to projected relative sea level rise.
	9) Air Quality	Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat over 50- year period of analysis reduces function of swamp vegetation to act as natural filter for air pollutants.	Restoration of 1,602 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 1,459 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 820 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 3,061 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 2,279 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 2,422 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.	Restoration of 3,881 acres of freshwater swamp/bottomland hardwood habitat may act as natural filters for air pollutants.
	10) Noise	Increased human activities within the study area may increase noise levels.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.	Short term, localized and temporary increased noise due to construction. Long term, impacts similar to No-Action Alternative.
	11) Vegetation Resources: Riparian Vegetation	Degradation of riparian vegetation would continue as swamp converts to open water.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.	There would be creation of riparian habitat along new conveyance channels. Riparian vegetation on dredged material berms impacted by construction.
	12) Vegetation Resources: Wetland Vegetation	Degradation of wetland vegetation would continue with conversion of 18,204 acres of existing swamp to fresh marsh and open water over 50-year period of analysis.	A net total of 1,602 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 1,459 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 820 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 3,061 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 2,279 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 2,422 acres of baldcypress-tupelo swamp habitat hydrologically restored.	A net total of 3,881 acres of baldcypress-tupelo swamp habitat hydrologically restored.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	13) Vegetation Resources: Upland Vegetation	Upland vegetation along ARDC berms likely unchanged over 50-year period of analysis	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.	Upland vegetation on ARDC berms converted to conveyance channel.
	14) Vegetation Resources: Submerged Aquatic Vegetation (SAV)	Presently there is little to no habitat for SAV due to invasive species out-competing them. This would likely stay unchanged over 50-year period of analysis.	Creation of 18.6 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 10.5 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 7.2 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 29.1 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 17.7 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 25.8 acres of conveyance channels would create a healthy habitat for SAV.	Creation of 36.3 acres of conveyance channels would create a healthy habitat for SAV.
	15) Vegetation Resources: Invasive Species	Invasive species would continue to spread throughout the study area.	Reconnecting hydrology to 1,602 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 1,459 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 820 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 3,061 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 2,279 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 2,422 acres of swamp makes conditions conducive for invasive species to continue spreading.	Reconnecting hydrology to 3,881 acres of swamp makes conditions conducive for invasive species to continue spreading.
	16) Wildlife Resources	Continued conversion of 18,204 acres of bottomland swamp to fresh marsh and open water habitat.	Connected hydrology improves 1,602 acres of swamp habitat for wildlife use.	Connected hydrology improves 1,459 acres of swamp habitat for wildlife use.	Connected hydrology improves 820 acres of swamp habitat for wildlife use.	Connected hydrology improves 3,061 acres of swamp habitat for wildlife use.	Connected hydrology improves 2,279 acres of swamp habitat for wildlife use.	Connected hydrology improves 2,422 acres of swamp habitat for wildlife use.	Connected hydrology improves 3,881 acres of swamp habitat for wildlife use.
	17) Fishery Resources	Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat increases availability of open water habitat for fish and aquatic organisms. However, ARDC berms limit access; water quality decline makes environment suitable only for those aquatic organisms tolerant of low dissolved oxygen conditions.	Connected hydrology allows commercial and recreational fishery use in 1,602 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 1,459 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 820 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 3,061 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 2,279 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 2,422 acres of improved swamp habitat.	Connected hydrology allows commercial and recreational fishery use in 3,881 acres of improved swamp habitat.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	19) Aquatic Resources: Plankton	Plankton resources would not be able to filter nutrients from the watershed due to the lack of connectivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.	There would be temporary and localized impacts (e.g., decreased dissolved oxygen, increased turbidity) to plankton communities during construction. Long term, creation of conveyance channels in concert with marsh creation and nourishment would result in greater productivity.
	20) Aquatic Resources: Benthic	The amount of habitat available for benthos assemblages that utilize swamp or marsh edge habitats would likely decrease. The availability of nutrients and detritus from the decomposing swamp vegetation would initially increase and then decrease, causing the decline in habitat availability.	Wetland restoration and reconnecting hydrology of 1,602 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 1,459acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 822 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 3,061 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 2,279 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 2,422 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.	Wetland restoration and reconnecting hydrology of 3,881 acres would result in a greater export of dissolved organic compounds and detritus from the wetlands creating a healthier benthic habitat.
	21) Essential Fish and Habitat (EFH)	No EFH identified within SA. This designation would likely not change over the 50-year period of analysis.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.	Proposed action would not likely result in changes to EFH.
	22) Threatened and Endangered Species	Converted 18,204 acres of swamp habitat to fresh marsh and open water habitats would likely not be utilized by listed species.	Restored 1,602 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 1,459 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 820 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 3,061 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 2,279 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 2,422 acres of Maurepas Swamp would likely not be utilized by listed species.	Restored 3,881 acres of Maurepas Swamp would likely not be utilized by listed species.
	23) Cultural and Historic Resources	The land loss within the study area threatens the integrity of these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.	Ecosystem restoration would prevent further land loss and have positive effects on these resources.
	24) Aesthetics	Conversion of 18,204 acres of swamp vegetation to fresh marsh or open water habitat could reduce aesthetics.	Restoration of 1,602 acres of bottomland swamp would improve aesthetics.	Restoration of 1,459 acres of bottomland swamp would improve aesthetics.	Restoration of 820 acres of bottomland swamp would improve aesthetics.	Restoration of 3,061 acres of bottomland swamp would improve aesthetics.	Restoration of 2,279 acres of bottomland swamp would improve aesthetics.	Restoration of 2,422 acres of bottomland swamp would improve aesthetics.	Restoration of 3,881 acres of bottomland swamp would improve aesthetics.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	25) Recreational Resources	Support and sustainability of bottomland swamp recreational opportunities would decline over time with conversion to an open water system.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.	The proposed action would lead to improvements in swamp habitat, resulting in a higher number of recreational opportunities.
	26) Socioeconomic and Human Resources: Population and Housing	No impacts to population and housing would occur.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	27) Socioeconomic and Human Resources: Employment and Income	The employment and income of the residents would follow regional trends. Presently, close to 35% of the 477 study area residents are retired, and the unemployment rate is 7.2% in the parish.	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration.	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration	Minor positive effects in temporary and permanent labor would occur as a result of ecosystem restoration
	28) Socioeconomic and Human Resources: Community Cohesion	Several of the current subdivisions would expand. A proposed bridge over the ARDC would improve community cohesion.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	29) Socioeconomics and Human Resources: Environmental Justice	No disproportionate impacts on minority and/or low-income communities would occur.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	30) Socioeconomic and Human Resources: Infrastructure	Conversion of 18,204 acres of swamp vegetation to fresh marsh or open water habitat may affect relocations and maintenance of infrastructure within the study area.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.	Restoration could provide protection by reducing inundation, wave action, and erosion.
	31) Socioeconomic and Human Resources: Business and Industry	Wetland land loss potentially threatens businesses in the study area.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.	Improvements and nourishment of swamp habitat would sustain business and industry.
	32) Socioeconomic and Human Resources: Traffic and Transportation	Wetland land loss threatens the stability of roads passing through area, resulting in increased maintenance. Several of the current subdivisions would expand, creating additional roads, bridges, and traffic.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of road damages and relocations needed compared to the no-action alternative.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	33) Socioeconomic and Human Resources: Public Facilities and Services	Wetland land loss threatens public facilities and services and increases maintenance. Several of the current subdivisions would expand, creating additional needs for public facilities and services.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.	This alternative would reduce the amount of maintenance and relocations needed compared to the no-action alternative.
	34) Socioeconomic and Human Resources: Local Government Finances	Increasing population growth increases local government finances.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	35) Socioeconomic and Human Resources: Tax Revenue and Property Values	Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions. At the same time, property values may drop from lowering aesthetics due to swamp degradation.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.	Property values may increase with improved aesthetics.
	36) Socioeconomic and Human Resources: Community and Regional Growth	Additional increases in community and regional growth would be sustained through the filling of lots in the existing and proposed subdivisions.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	37) Socioeconomic and Human Resources: Land Use Socioeconomics – Agriculture	Agricultural lands, primarily livestock pastures, would continue to be used.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.	There would be no impacts to agriculture as a result of the proposed alternative as there are no agricultural lands in the area impacted by this alternative.
	38) Socioeconomic and Human Resources: Land Use Socioeconomics – Forestry	Little timber harvesting would take place in the future due to a lack of quality timber.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.	There would be restoration easements as a result of the proposed alternative, limiting forestry activities.
	39) Socioeconomic and Human Resources: Land Use Socioeconomics – Public Lands	A portion of the Maurepas WMA is the only public lands present in the study area. These lands may be adversely affected by future sea level rise.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.	Minor beneficial impacts to public lands in study area.

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	40) Socioeconomic and Human Resources: Water Use and Supply	There would continue to be little significant public use of surface waters (other than for recreation) in the study area.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	41) Socioeconomic and Human Resources: Navigation	Blind River, ARDC, Bayou Manchac, and Amite River are likely to continue to be used primarily for recreational navigation; continued degradation could result in increased maintenance issues.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.	Wetland restoration would continue to give protection to navigational waterways from marine conditions.
	42) Socioeconomic and Human Resources: Man-Made Resources – Oil, Gas, and Utilities	Pipelines serving wells may need to be relocated and/or re-buried due to the conversion of 18,204 acres of swamp vegetation to fresh marsh or open water habitat.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.
	43) Socioeconomic and Human Resources: Man-Made Resources – Oil, Gas, and Utilities – Pipelines	Relocations and/or re-burying of pipelines due to the conversion of 18,204 acres of swamp vegetation to fresh marsh or open water habitat would likely occur.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.	Reduction in relocations and re-burying needed compared to the no-action alternative.
	44) Socioeconomic and Human Resources: Man-Made Resources – Flood Control and Hurricane Protection Levees	Continued degradation of wetlands would result in an increase in localized storm surge and storm wave damages. The Amite River and Tributaries (AR&T) Federal flood control project is in the study area. Municipal and parish flood control measures, including drainage canals and control structures, are present in the study area.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.	There would be a minor decrease in storm surge and risk of flooding due to coastal land retention.
	45) Socioeconomic and Human Resources: Natural Resources – Commercial Fisheries	There are limited commercial fisheries present at this time. Production would not be affected.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
	46) Socioeconomic and Human Resources: Natural Resources – Oyster Leases	SA provides no habitat suitable for oysters or oyster leases. Unlikely oyster habitat or leases would develop over 50-year period of analysis.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.	Proposed action would provide no habitat suitable for oysters or oyster leases.

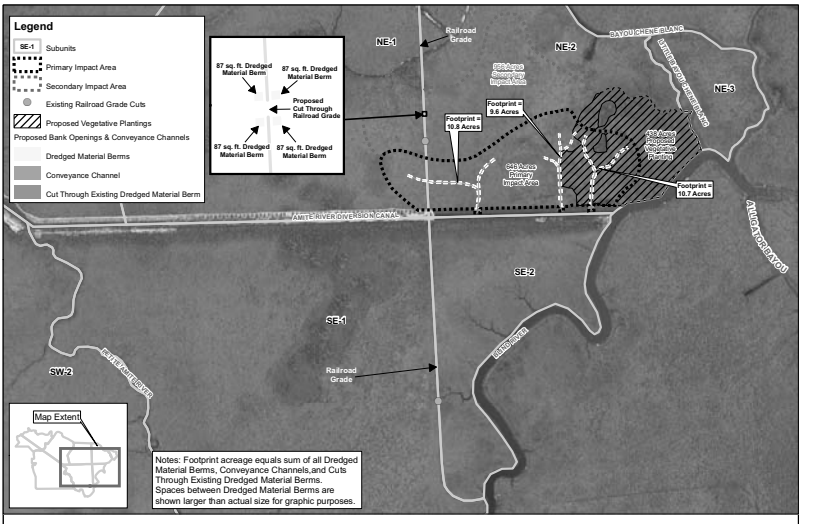
		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	47) HTRW	An HTRW Phase I ESA was performed and identified a low probability of encountering contaminants of concern. Increasing human populations, development, industry, and other activities in adjacent areas could increase potential for HTRW in SA.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.	Impacts would be similar to the No-Action Alternative.
3. Plan Evaluation	**A. Contribution to Planning Objectives**								
	1) Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.	0	2	2	2	2	2	2	2
	2) Reduce habitat conversion of swamp to open water over the 50-year period of analysis.	0	2	2	2	2	2	2	2
	3) Facilitate natural hydrologic cycles over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.	0	2	2	2	2	2	2	2
	4) Improve fish and wildlife habitat over the 50-year period of analysis.	0	2	2	2	2	2	2	2

0=Does not meet

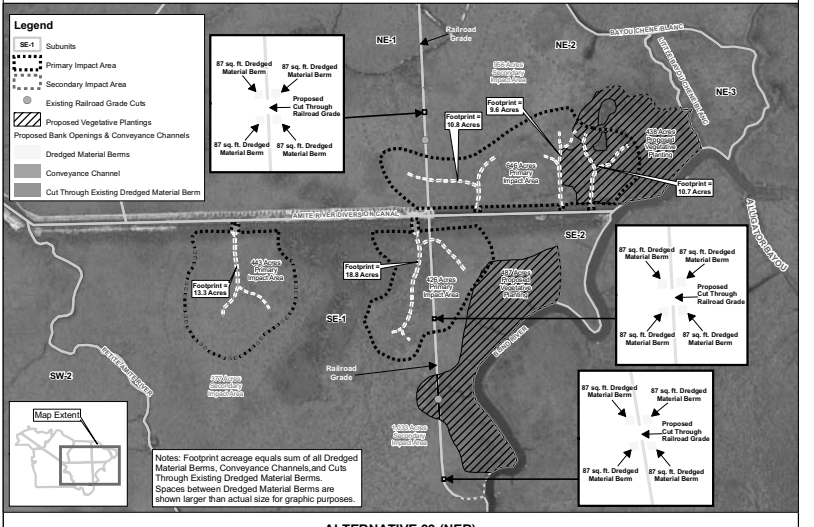
1=Partially meets

2=Meets

		No-Action	Alternative 33 (Recommended Plan)	Alternative 34	Alternative 35	Alternative 36	Alternative 37	Alternative 38	Alternative 39
	B. Planning Constraints								
	1) Flood control	2	2	2	2	2	2	2	2
	2) Designated Scenic Rivers	2	2	2	2	2	2	2	2
	3) Hydroperiod	0	2	2	2	2	2	2	2
	C. Response to Evaluation Criteria								
	1) Completeness	0	2	2	2	2	2	2	2
	2) Effectiveness	0	2	2	2	2	2	2	2
	3) Efficiency	0	2	2	2	2	2	2	2
	4) Acceptability	0	2	2	2	2	2	2	2
0=Does not meet									
1=Partially meets									
2=Meets									



ALTERNATIVE 33 (TSP)



ALTERNATIVE 39 (NER)

N

0 2,000 4,000 6,000 Feet

ALTERNATIVE 33 AND ALTERNATIVE 39 COMPARISON

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3.27
Date: July 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1874

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Table 3.16 Comparison of the NER and Recommended Plan

	Alternative 39 (NER)	Alternative 33 (Recommended Plan)
MCACES Costs		
Channels & Canals	$9,210,000	$4,450,000
Monitoring	$3,660,000	$2,970,000
Construction Estimate Total	$12,870,000	$7,420,000
Federal Share Construction Estimate	$8,370,000	$4,820,000
Non-Federal Share Construction Estimate	$4,500,000	$2,600,000
Lands & Damages	$390,000	$180,000
Planning, Engineering & Design	$1,110,000	$534,000
Construction Management	$829,000	$401,000
Project Cost Total	$15,200,000	$8,540,000
Federal Share Cost Total	$9,880,000	$5,550,000
Non-Federal Share Cost Total	$5,320,000	$2,990,000
Benefits		
Benefits (AAHUs)	1,602	679
Annualized Cost/AAHU	$480	$660

Notes: Costs represent the "fully funded" project estimate including interest during construction. Discount Rate of 4.375 percent Utilized for Annualized Costs.

Table 3.17 Maximum Cost Including Inflation through Construction

Authorized cost in WRDA 2007 Title VII, Section 7006 (e)(3)(A):	$5,600,000
* Cost Index Used EM 1110-2-1304 (Revised 31 Mar 2010)	CWBS Feature Code 09 – Channels and Canals
Cost Index Ratio 1Q FY07 to 3Q FY15	1.20
** Current Project Cost Estimate (Inflation applied from 10/2006 to 4/2015)	$6,711,849
20% of Authorized Cost:	$1,120,000
*** Monitoring & Adaptive Management: (per WRDA 2007 Section 2039)	$2,971,200- $45,000 = $2,926,200
Maximum Cost Limited by Section 902:	$6,711,849+ $1,120,000 +2,926,200 = **$10,760,000**
****Recommended Plan cost	**$8,540,000**

Notes: * The cost index applied is derived from: EM 1110-2-1304, 31 Mar 10, Civil Works Construction Cost Index System (CWCCIS).** For the purposes of applying the Cost Index to the WRDA Authorized Cost, each project was adjusted for inflation from October 2006 price levels to the midpoint of construction.*** The cost of any modifications required by law. This is derived from section 8.0 of each projects Monitoring and Adaptive Management Plan minus the project monitoring cost found on the LCA Cost Summary Worksheet - October 2004 Price Levels modified study cost Dec 20 2004. Figures in calculations are actual and not rounded. Final numbers in bold are rounded.****Represents fully funded cost estimate including interest during construction.

- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.
- Environmental easements on 1,633 acres of land

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project.

Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, would be based on four design cross-sections (Figures 3.5 through 3.8). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches through dredged material berm, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The benches are 25-foot wide flat areas, located above the average water level, on both sides of the conveyance channel. These benches will be included in the portions of the conveyance channel to be cut through the existing dredged material berms. The 70-foot cut section with benches was designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. The quantities

associated with each alternative are found in Table 3.5. Table 3.6 summarizes the features associated with each alternative within the final array. A typical depiction of the conveyance channels is found in Figure 3.9.

The Recommended Plan would provide environmental benefits as follows:

- Restoring and benefitting 1,602 acres of freshwater swamp habitat; freshwater swamp habitat has been identified nationally as institutional, public, and technical significance. This significance is due to the ecosystem functions that include fish and wildlife habitat, water quality benefits, pollutant filtration, groundwater charge and recharge, habitat for threatened and endangered species, carbon sequestration, aesthetics, and recreations;
- Creating a net of 679 Average AAHUs; AAHUs are a measure of ecological benefits as output from the WVA. An AAHU is the equivalent of improving one acre from a totally non-functioning habitat (0 percent functioning) to a fully functional one (100 percent), as well has to take two acres from a 50 percent functional level to a 100 percent functional level. More AAHU and WVA detail are presented in 3.5.2. The benefits of this project would be to essentially restore the equivalent on 679 acres of a 100 percent functioning freshwater swamp from a 679 acres of a completely non-functioning habitat;
- Creating 5.0 acres of bottomland hardwood habitat;
- Establishing hydrologic connectivity between the ARDC and the western Maurepas Swamp allowing the swamp to drain during seasonal low-flow conditions in the Amite River and allowing nutrients and sediments to be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events;
- Reducing the likelihood of the swamp being converted to marsh or open water;
- Promoting the germination and survival of the seedlings of bald cypress and other trees;
- Improving biological productivity and reducing further habitat deterioration.

3.7.2 Design, Environmental, and Construction Considerations

Design Considerations. Alternative 33 (Recommended Plan) utilizes the addition of cuts in the north dredged material berms along with bifurcated conveyance channels to reduce impoundment and increase hydrologic connectivity between the ARDC and subunits NE-1 and NE-2. All cut locations were placed to maximize the potential for flow into and out of the impounded swamp habitat. Additionally, one cut is placed in the existing railroad grade to further reduce impoundment and improve flow within these areas. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

The cross-sectional dimensions of the conveyance channels were designed to mimic natural cuts found within the southern portion of SE-2 and along Blind River. These natural cuts facilitate drainage for an area similar in size to those required in NE-2 and are considered to be in a state on hydrologic equilibrium. The surveys of the existing channels are presented in Appendix L. These cuts represent natural equilibrium dimensions which have formed based on drainage requirements similar to the hydrologic subunits involved in this restoration study. Additional cross-sectional area was provided for the cut portion within the existing dredged material berms so as to allow high-water flows through this portion of proposed conveyance system. Additional geotechnical data will be collected during PED and will be used to verify the channel design (Appendix L).

Vegetative plantings are added to the most highly-degraded areas within NE-2 to increase the potential for reversing habitat conversion and to provide a seed source, thereby increasing vegetative regeneration within this portion of the study area. These plantings will be implemented in two phases. A primary planting will be implemented in the designated areas one year after the earthmoving phase of construction is completed. The period of time between excavation and the primary plantings will allow the disturbed material to compact into a more suitable substrate. This time will also allow for the determination of an appropriate planting scheme. Sixteen months after the primary plantings are completed; a mortality analysis will be conducted to establish the quantity of plantings required for the secondary planting. It is assumed that 50 percent of the initial plantings will perish. Four months after this determination is made a secondary planting will be implemented. Both the primary and secondary plantings will consist of 173 trees per acre. Each acre planted will be composed of 75 percent bare-root, 15 percent one-gallon potted, and 10 percent three-gallon potted plants. These plantings are considered an important component of the restoration design, due to the native regeneration they would provide for the highly degraded areas of impact. The planting should only occur during the non-growing season (November to March) and it is recommended that at least one year elapse after construction before planting such that soils in the impounded areas could recover and the dredged material berms reach a stable elevation. The plant list for the dredged material areas would be developed based upon this final elevation.

3.7.3 Real Estate Requirements

Construction of Alternative 33 (Recommended Plan) would require the acquisition of required easements to allow for the construction of the project and to ensure that all project benefits are protected. These real estate acquisitions include flowage, wetland, and channel easements for the appropriate portions of the construction footprint. The real estate cost required for implementation of Alternative 33 (Recommended Plan) is estimated at approximately $180,000 (Appendix J).

3.7.4 OMRR&R Considerations

OMRR&R requirements for Alternative 33 (Recommended Plan) include a yearly inspection of the bank opening locations and conveyance channels to ensure that there are no flow interruptions, such as from debris or fallen trees. Upon inspection it would be determined if blockage removal or some other appropriate remedial operation is required. Since the channel designs were based on stable, existing channel that require no maintenance, no blockage is anticipated. However, some maintenance is being planned for in the event that high water soon after construction could move some debris and block the channel. Once these areas stabilize, little to no maintenance would be required.

The conveyance channels would be naturally altered over time, eventually reaching a state of hydrologic equilibrium similar to the relict channels that the conveyance channels were designed to mimic. These changes would most possibly result in changes to the geomorphology of the channel along with a transition to a more meandering channel makeup and would not reduce the expected benefits of Alternative 33 (Recommended Plan). Therefore, it is anticipated that little to no attempt to maintain the depth or shoreline geometry of the conveyance channels would be necessary. The non-Federal sponsor would be required to enforce any restrictions as identified in the easements to ensure that the benefits of Alternative 33 (Recommended Plan) are retained.

3.7.5 Monitoring Plan and Adaptive Management

3.7.5.1 Description of Monitoring Activity and Adaptive Management

Monitoring is critical to understanding how effective a project is with respect to meeting its goals and objectives. Project and system level objectives must be identified to determine appropriate indicators to monitor. In order to be effective, monitoring designs must be able to discern ecosystem responses due to project implementation (i.e., management actions) from natural variability. In coastal Louisiana, there are many existing restoration and protection projects constructed, and many more planned under a multitude of different authorizations and programs, which will ultimately influence much of coastal Louisiana. Monitoring must therefore be conducted at project and system-wide scales, and nested to support long-term, large-scale status and trends and short-term performance assessments.

When possible, specific monitoring and large scale information needs should be integrated with monitoring efforts that are underway in coastal Louisiana. The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) produced a program that has been monitoring restoration and protection projects in coastal

Louisiana since 1990 (Steyer and Stewart 1992, Steyer *et al.* 1995). The monitoring program incorporates a system-level wetland assessment component called the Coast-wide Reference Monitoring System (CRMS-Wetlands, Steyer *et al.* 2003). CRMS-Wetlands provide system-wide performance measures that are evaluated to help determine the cumulative effects of restoration and protection projects in coastal Louisiana. LCA monitoring plans should benefit from existing monitoring networks to the extent practicable and participate in the implementation of CRMS-Wetlands. The CRMS stations, which are capable of monitoring RSLR, could also be utilized in the future as a means of adaptive management for RSLR. Consideration could be given to additional monitoring efforts as well. Such participation can maintain the data consistencies necessary to conduct project assessment and programmatic adaptive management.

A feasibility level monitoring and adaptive management (AM) plan has been developed for the project (Appendix I). The monitoring and AM plan was developed to include the proposed monitoring and to consider and identify any necessary AM activities. The plan also estimates the costs and duration of the monitoring and applicable AM components.

The primary incentive for implementing an adaptive management program is to increase the likelihood of achieving desired project outcomes in the face of uncertainty. Adaptive management provides an organized, coherent and documented process that defines management actions in relation to measured project performance compared to desired project outcomes.

Principal sources of uncertainty common to management and restoration projects include (1) incomplete description and understanding of relevant ecosystem structure and function, (2) imprecise relationships between project management actions and corresponding outcomes, (3) engineering challenges in implementing project alternatives, and (4) incoherent management and decision-making processes.

In the case of the LCA-ARDC Modification project, the following questions were considered to determine if adaptive management should be applied to the project. A "NO" answer to questions 1 through 3 and a "YES" answer to question 4 indentifies the project as a candidate that could benefit from adaptive management.

(1) Are the ecosystems to be restored sufficiently understood in terms of hydrology and ecology, and can project outcomes be accurately predicted given recognized natural and anthropogenic stressors?
(2) Can the most effective project design and operation to achieve project goals and objectives be readily identified?
(3) Are the measures of this restoration project's performance well understood and agreed upon by all parties?

(4) Can project management actions be adjusted in relation to monitoring results?

Answers to questions 1 through 3 were "NO." However, the Adaptive Management Framework Team determined that the Amite River Diversion Canal Modification project was not a good candidate for adaptive management because there are no actions that could be taken in response to monitoring results that the USACE would define as adaptive management actions. That is, the answer to question 4 is "NO." Although some activities could be conducted to adjust project performance, these actions would not be considered adaptive management activities. O&M for the selected plan includes a yearly inspection of the bank opening locations and conveyance channels to ensure that there are no flow interruptions, such as from debris or fallen trees, which could improve project performance. However if monitoring data indicate that actions beyond yearly O&M (i.e changing the shape, size, branching, or number of conveyances channels or gaps) would be needed these would be considered structural changes and are beyond the adaptive management authority. The USACE and State of Louisiana can initiate the process for developing a new water resources project or pursue a design deficiency under the constructed project. The Framework Team also considered opportunities for active adaptive management by designing the project as a management experiment. The Team determined there were minimal active adaptive management opportunities for the project and that any lessons learned would be limited and would not likely apply to other coastal Louisiana restoration projects. While there are currently no apparent adaptive management opportunities, the Adaptive Management Planning Team can examine the performance of the project in the future. If it is determined during PED that adaptive management could help achieve any unfulfilled project objectives, the Team can recommend adaptive management for the project at that time.

Independent of adaptive management, an effective monitoring program will be required to determine if the project outcomes are consistent with original project goals and objectives. The power of a monitoring program developed to support adaptive management lies in the establishment of feedback between continued project monitoring and corresponding project management. A carefully designed monitoring program is central to properly assessing the effects of the Amite River Diversion Canal Modification project.

3.7.5.2 Performance Measures for Monitoring

The plan identifies performance measures along with desired outcomes and monitoring designs in relation to specific project goals and objectives. Additional monitoring is identified under supporting information needs to help further understand and corroborate project effects;

Objective 1: Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients.
Performance Measure 1: Freshwater distribution during operational events

Desired Outcome: Increase hydrologic connectivity and area of extent of freshwater movement into project area above pre-project conditions.

Monitoring Design: Synoptic hydrologic surveys, using salinity, temperature, dissolved oxygen, and velocity as tracers, will be conducted during selected low flow and high flow operational events to track distribution of freshwater. Sampling will be conducted twice annually in the first three years and as required thereafter.

Objective 2: Facilitate natural hydrologic cycles within the study area by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC which would improve tree productivity and seedling germination.

Performance Measure 2a: Swamp vegetation production and extent.

Desired Outcome: Increase in basal area increment of baldcypress and tupelo in the swamp from existing conditions (existing conditions defined from pre-construction measurements from CRMS-Wetlands stations and Southeastern Louisiana University historical monitoring).

Monitoring Design: Diameter at breast height (dbh) and overstory tree cover will be measured in the fall in two pre-construction years and four post-construction years (within the first 10 years).

Performance Measure 2b: Number of baldcypress and tupelo saplings.

Desired Outcome: A 25 percent increase in the number of naturally recruited baldcypress and tupelo saplings per acre from pre-project conditions 10 years after project implementation. Performance of this measure is most dependent on achieving extended dry periods in the swamp.

Monitoring Design: Understory vegetation (herbaceous, seedling, and sapling) will be measured in the fall in two pre-construction and four post-construction years (within the first 10 years) to assess regeneration and changes in cover classes.

Performance Measure 2c: Depth, duration and frequency of flooding in the swamp.

Desired Outcome: Increase or decrease from pre-project conditions average flood durations (existing conditions defined from pre-construction measurements from CRMS-Wetlands stations).

Desired Outcome: Maintain dry periods (moist soils) in the swamp for a minimum 7-35 days during summer and early fall for seed germination and maintain water levels below seedling height to promote seedling survival.

Monitoring Design: Water-level recorders will be deployed in six key areas to measure water depths at the needed frequencies. Recorders will be established three years prior to construction to determine existing conditions and will be monitored for 10 years post-construction or until desired outcomes are achieved.

Supporting Information Need: A deep rod-surface elevation table (RSET) rod will be installed where hydrologic measurements are taken to establish an elevation benchmark.

Objective 3: Reduce habitat conversion from swamp to marsh and open water within the study area.

Performance Measure 3: Habitat and land:water classification
Desired Outcome: Maintaining immediate pre-construction acreage of baldcypress-tupelo swamp acreage after 10 years.

Monitoring Design: Habitats will be classified using Landsat Thematic Mapper (TM) scenes and Digital Orthophoto Quarter Quadrangles (DOQQs) for one pre- and four post-project years in the study area to assess trends in conversion between swamp, herbaceous marsh, and open water.

Supporting Information Need: Salinity data will be collected in order to characterize potential salinity stress associated with low water conditions in the fall, droughts, and intrusions associated with tropical cyclone events.

Objective 4: Improve fish and wildlife habitat within the study area.

Performance Measure 4: No applicable performance measure.

Desired Outcome: Swamp production and hydroperiod measures will be used to assess this objective.

Monitoring Design: Fish and wildlife habitat is linked to the performance measures associated with objectives 1-3, focused on improving habitat. Therefore, no specific monitoring is proposed for this objective.

3.7.5.3 Cost and Duration of Monitoring and Adaptive Management

The costs associated with implementing the monitoring and adaptive management plans was estimated based on currently available data and information developed during plan formulation as part of the feasibility study. Because uncertainties remain as to the exact project features, monitoring elements, and adaptive management opportunities, the costs estimated will be need to be refined in PED during the development of the detailed monitoring and adaptive management plans. The estimated cost for the monitoring program is $2,970,000 over 10 years, following the completion of project construction. These costs are budgeted as construction costs.

In accordance with WRDA 2007 Section 2039 the monitoring costs presented in the report are for the full allowable 10-year period and represent conservative and comprehensive cost. Section 2039 guidance does allow for the monitoring to end prior to the 10-year period if the Secretary determines that the success criteria have been met. The costs presented in the report are for the full 10-year period but may end much sooner than 10 years. The monitoring plans and costs were developed by the interagency LCA Adaptive Management Planning Team in conjunction with stakeholders and have been determined to be a reasonable plan and estimate for what is needed and necessary to be able to determine project success.

3.7.6 Effectiveness of Recommended Plan in Meeting Goals and Objectives

The proposed action selected as the Recommended Plan, meets all of the goals and objectives listed in Section 2.4 of this study and has been determined to have minimal impacts on significant resources, as described in Table 3.15. The manner in which each objective and goal is achieved is listed below.

***Objective 1*:** *Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.*

With the addition of cuts and conveyance channels, H&H modeling has shown that hydrologic connectivity would be increased within the designated areas of impacts for the subunits determined to be in the most need of restoration. This

connectivity would add to the seasonal flows needed to maintain healthy swamp habitat and would increase the exchange of sediments and nutrients between the ARDC and the interior swamp areas.

Objective 2**:** *Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.*

With implementation of Alternative 33 (Recommended Plan), added conveyance, reduced impoundment, and implementation of vegetative plantings, would result in a reduction of habitat conversion to freshwater marsh for 1,602 acres of degraded cypress-tupelo swamp. It is also anticipated that the regeneration of native swamp vegetation would be increased with the implementation of this proposed action, thereby creating a self-sustaining swamp habitat.

Objective 3**:** *Facilitate natural hydrologic cycles within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.*

The cuts placed within the existing dredged material berm, along with the conveyance channels, would allow the swamp habitat adjacent to the ARDC to drain high-salinity waters introduced by tropical storm events and allow for seasonal hydrologic flow to occur within the areas of impact. The increased conveyance observed from seasonal hydrology would produce increased sheet flow, resulting in nutrient and sediment input as well as a flushing action for the areas of impact within Alternative 33 (Recommended Plan). This would produce the type of hydrologic cycles required to maintain and promote healthy swamp habitat. The resulting reduction in impoundment will increase the number of dry days occurring within the areas of impact, in turn increasing seed germination and promoting natural succession.

Objective 4**:** *Improve fish and wildlife habitat within the study area over the 50-year period of analysis.*

The implementation of Alternative 33 (Recommended Plan) would improve the ecosystem by creating a net gain of 679 AAHUs within the areas of impacts. These benefits quantify habitat improvements for fish and wildlife that thrive in cypress-tupelo swamp habitat. The placement of the dredged material along the proposed conveyance channels, existing railroad grade, and existing dredged material berms would also provide areas of bottomland hardwood habitat for wildlife to use during high-water periods. The vegetative plantings on the placed dredged material and within the degraded swamp also provide habitat diversity and sustainability within the areas of impact.

3.7.7 Effectiveness of Recommended Plan in Meeting Environmental Operating Principals

Alternative 33 (Recommended Plan) would benefit 1,602 acres of cypress-tupelo swamp habitat, resulting in a net gain of 679 AAHUs with little to no negative environmental impacts. This would reverse the trend of conversion from swamp to freshwater marsh habitat within the areas of impact, while adding habitat sustainability and diversity. The Recommended Plan provides a significant amount of benefits and has been agreed upon by the PDT, including Federal and state agencies, as being the most beneficial plan within the authorized cost for the study area.

3.7.8 Compensatory Mitigation Measures

Implementation of Alternative 33 (Recommended Plan) would result in a net gain in wetland habitat; therefore, compensatory mitigation, as stipulated in the Clean Water Act, is not required. In order to offset the loss of habitat resulting from the placement of dredged material within the areas of impact, 5.0 acres of vegetative plantings of additional tree species, such as sweet gum and live oaks, would be implemented on the placed material to create bottomland hardwood habitat. This habitat could be utilized by some wildlife for available land and food during high-water periods. The addition of these areas also provides habitat diversity within the areas of impact. The Recommended Plan would result in a net gain in habitat units; therefore, no compensatory mitigation for construction of this project is required.

3.7.9 Micro-Computer Aided Cost Estimating System

In order to obtain a more thorough analysis of the costs associated with the recommended plan (Alternative 33), a Micro-Computer Aided Cost Estimating System (MCACES) cost estimate was conducted on the recommended plan. This estimate included all items listed in Section 3.5.1 of this report, with the addition of various project-specific considerations such as contingencies and localized cost items such as sales tax and labor rates. The contingency costs were determined based on a risk analysis as shown in Section 3.8 of this report. The overall cost of the recommended plan was estimated to be $8,540,000 (fully funded). The full MCACES estimate report may be found in Appendix L of this report.

3.7.10 Construction Considerations

It is estimated that construction of the earthmoving portion of the recommended plan (Alternative 33) would take approximately six months. This duration includes the mobilization and demobilization of the required equipment and laborers and the construction of all three gaps and conveyance channels. The first implementation of vegetative plantings within the appropriate swamp and bottomland hardwood habitat would commence approximately 12 months after completion of earthmoving

construction. This period of time is required to allow the impounded soils to recover and to allow the dredged material berms to settle. The final elevation of the dredged material berms is a critical component of determining the correct tree species to plant. Supplementary plantings would likely be required at a later date, depending on the mortality rate of the first plantings. It is estimated that the secondary plantings would commence approximately 28 months after the initial plantings are completed. A chart depicting the construction schedule as well as the planting contract schedule can be found in Appendix L.

Once the appropriate equipment is mobilized to the project site via trucks and barges, construction of the gaps would commence by clearing and grubbing the designated footprints of construction on both sides of the ARDC. Stumps are to be removed from the portions of excavation within the proposed channels, but only trees would be cleared along the benches, 10-foot gaps and material placement areas. Cleared trees would be placed in the same area with the stumps and dredged material in a manner that does not impede hydrologic connectivity. Once clearing is completed at one cut location, the equipment would be mobilized to another cut location so excavation could begin.

Excavation of the cuts within the existing dredged material berms and the proposed conveyance channels would be carried out by a short-reach, hydraulic excavator mounted on flexi-float mats or amphibious equipment. As the equipment cuts its way into the cut locations, the dredged material would be placed along the cuts and conveyance channels as shown in Figure 3.9. The excavated cuts and channels would serve as the area in which equipment would move in and out of the construction area. Some amphibious equipment would most likely be needed to accomplish the incremental movement of the mats.

Upon completion of the excavation, vegetative plantings would be carried within the predetermined areas of the swamp and material placement. Approximately 173 trees per acre would be planted. Each area planted would consist of approximately 25 percent potted seedlings and 75 percent bare-root seedlings. Cypress and tupelo gum would be planted within the swamp floor areas and hardwoods such as live oaks and sweet gum would be planted on both the newly created and existing dredged material berms. The final species list would have to be determined after the dredged material berms settle to ensure the correct trees are planted. Nutria guards would be required on every tree planted in order to ensure a reasonable success rate. It is expected that the replanting of 50 percent of these areas would be necessary within a few years of the conclusion of cut and channel construction. The monitoring activities required for this project, such as the mortality of vegetative plantings, are found in Appendix I. No relocations of infrastructure or utilities would be required during construction of the Alternative 33 (Recommended Plan). The estimated schedule for project implementation is shown in Table 3.18.

3.7.11 Significance

Ecosystem restoration is one of the primary missions of the USACE Civil Works program. The USACE's objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to NER (outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity, and is expressed quantitatively in physical units or indexes. These net changes are measured in the planning area and in the rest of the Nation.

Louisiana contains one of the largest expanses of coastal wetlands in the contiguous United States and accounts for 90 percent of the total coastal wetland loss occurring in the Nation. The Maurepas Swamp complex is the second largest continuous coastal forest in Louisiana, comprising over 190,000 acres of freshwater swamp habitat. The LCA ARDC study area is an essential ecosystem since it includes wetland habitats and provides high fish and wildlife value as well as habitat for migratory birds and other aquatic organisms including threatened or endangered species.

The swamp habitat surrounding the ARDC has been historically used for hunting, fishing, bird watching, and trapping. The restoration of the freshwater swamp habitat surrounding the ARDC would protect these national assets from further degradation. The restoration and protection of this swamp system will further protect the human infrastructure from the damages of storm surges and would protect the habitat for many species, including neotropical migrants.

3.7.11.1 Rationale for the Recommended Plan

The Recommended Plan meets both 2004 and current planning objectives. The Recommended Plan is an implementable increment of the NER plan, has been determined to be cost effective, is within the cost and scope of the authorization, has stand-alone utility, is supported by the non-Federal sponsor, and can be justified based on ecosystem restoration benefits, and addresses problem stipulated by the CEM. The Recommended Plan will restore 1,602 acres of cypress-tupelo swamp habitat and will create five acres of bottomland hardwood habitat for the 50 year period of analysis. Freshwater swamp habitat for essential fish and wildlife species will be restored, mimicking as closely as possible, conditions which occur naturally in the area. The alternatives were designed to work with the natural, fluid, soft environment of coastal Louisiana.

Table 3.18 Recommended Plan (Alternative 33) Construction Schedule

ARDC Alternative 33 Earthmoving Construction Schedule													
		Dredged Material Berm			Swamp		Equipment Utilized (Hours)						
Week*	Mob	Clear Trees	Land-Based Earthwork	Marsh Backhoe Work	Clear Trees	Marsh Backhoe Work	Log Skidder	D6 Dozer	Marsh Backhoe	Barge	Tug Boat 900hp	Crew Boat**
NTP												
2	MOB											40
3							40	40	80	40	40	40
4		Cut 1					40	40	80	40		40
5				Cut 1			40	40	80	40		40
6			Cut 1		Cut 1		40	40	80	40	20	40
7		Cut 2					40	40	80	40		40
8							40	40	80	40		40
9			Cut 2		Cut 2		40	40	80	40	20	40
10		Cut 3				Cut 1	40	40	80	40		40
11				Cut 2			40	40	80	40		40
12			Cut 3		Cut 3		40	40	80	40	20	40
13									80	40		40
14									80	40		40
15									80	40		40
16						Cut 2			80	40	20	40
17				Cut 3					80	40		40
18									80	40		40
19									80	40		40
20									80	40		40
21									80	40		40
22						Cut 3			80	40		40
23	Demob								80	40	40	40
						Totals	400	400	1,680	840	160	880

* Cells are completion by end of specific week
** Contingency Hours Added for Repairs Etc.

The project will restore natural hydrologic connectivity to the interior swamp surrounding the ARDC, while also reducing impoundment. The increased connectivity will result in increased sediment and nutrient input, which will facilitate seed germination and increase tree growth and canopy within the areas of impact. This increase in vegetative productivity will allow the restored area to continue to function and provide habitat with minimum continuing intervention. Without this project, the LCA ARDC study area will continue to degrade, with the eventual conversion of 18,204 acres of freshwater swamp habitat to marsh and open water. By reducing the impoundment of storm surge and restoring overland flow to the swamp habitat surrounding the ARDC, the Recommended Plan would allow the ecosystem to "self-regulate," by letting natural hydrologic and ecosystem processes to take over. Per ER 1105-2-100 Section E-30, "The objective of Civil Works ecosystem restoration is to restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. However, partial restoration may be possible, with significant and valuable improvement made to degraded ecological resources." The Maurepas swamp provides important hydrologic and habitat functions within the wetlands of coastal Louisiana. Loss of these functions would have impacts beyond the project study area.

Problems discussed in Section 1.5 of the November 2004 Louisiana Coastal Area (LCA) Ecosystem Restoration Study, as well as how they are addressed by the ARDC Modification study, are listed below:

- **Subsidence** is caused by a lack of sediment replenishing the soil that is removed from an area due to natural erosion or other forces. The Recommended Plan will address this problem by allowing hydrologic connectivity which will introduce sediments to the study area. Additionally, increases in canopy will result in increased biomass accretion, thereby reducing the impacts of subsidence.

- **Habitat switching**, occurs when one habitat converts to another habitat through succession. In Louisiana, this process is frequently due to changes in salinity levels or inundation. Examples of habitat switching may be a forested system converting to a freshwater marsh or a freshwater marsh converting to a saline marsh. The changes in habitat structure and/or composition result in a loss of one group of ecosystem services and may result in local rarity of a habitat type. More specifically, the study area is in danger of switching from a freshwater swamp to a marsh, and then potentially to open water. Through increased hydrologic connectivity, the Recommended Plan allows for nutrient and sediments to be introduced to the area to nourish the swamp and encourage indigenous flora and fauna to remain, thereby keeping the habitat intact. Vegetative plantings will help accelerate

and sustain the restoration of the swamp habitat by providing a seed source for vegetative regeneration.

- **Erosion of wetlands** is a result of stormwater runoff carrying sediment away that will not be replenished. The hydrologic connectivity created by the Recommended Plan would lead to the improvement of freshwater swamp habitat, increased basal width, and increased canopy. These improvements will prevent the further conversion of the native habitat.

- **Isolation from sediment and nutrients** has occurred as a result of the construction of the ARDC. This problem will be corrected by the proposed cuts in the dredged material berm, leading to hydrologic connectivity.

- **Saltwater intrusion** occurs when salt water brought in by high tide, storm events or some other method is not able to drain effectively from an area. Improving hydrologic connectivity to the study area would allow for impounded salinity to be flushed out more effectively.

- **Human-built infrastructure has modified the hydrology in the area.** This is the root cause of many of the problems identified in the ARDC study area. This will be addressed by making cuts in the ARDC dredged material berm and allowing for hydrologic connectivity between the ARDC and the surrounding study area.

- **The Mississippi River sediment load is deposited in deeper Gulf of Mexico** due to the controlling of the route of the Mississippi River. This marginally contributes to the problems in the ARDC study area, but measures to address this issue are outside the scope of this project.

- **A decline in sediment load from the Mississippi River** also contributes to the issues in the ARDC study area, but measures to address this issue are outside the scope of this project.

The project objectives addressed through implementation of the Recommended Plan are described in Section 3.7.6 of the report.

The significance of the ecosystem outputs plays an important role in ecosystem restoration evaluation per section E-37 of ER 1105-2-100. The outputs are institutionally recognized. The western Maurepas swamp serves as stopping ground for neotropical migratory bird species and provides habitat for bald eagles, Gulf sturgeon, and the West Indian Manatee. This project is listed in the Louisiana State Master Plan, and is designated as a critical near term feature in the LCA Ecosystem Restoration Study. There is public support in Louisiana for this project, with specific emphasis on beginning construction as soon as possible. The ARDC

and the surrounding swamp habitat are utilized for camping, fishing, and holiday celebrations. Commercial and recreational fishing are culturally significant to many south Louisiana residents. The wetlands provided by the western Maurepas swamp are nurseries for many fish species.

3.7.11.2 Significance of Recommended Plan

The outputs provided by the Recommended Plan are technically recognized. Examples of technical significance are:

- Scarcity: Louisiana's coastline represents 90 percent of the wetlands in the contiguous United States and is currently disappearing at an alarming rate. This unique and scarce habitat has high fish and wildlife values.

- Representativeness: The project footprint is uninhabited. The Recommended Plan will restore the interior swamp habitat by restoring natural flow regimes and using plantings of tree species native to the surrounding area.

- Status and Trends: The study area is exhibiting a decline in habitat. While the project cannot stop the natural processes of sea level rise and subsidence, the project can greatly slow down the disappearance of these landforms by decreasing impoundment and increasing hydrologic connectivity and flushing, as well as sediment and nutrient input within the areas of impact.

- Connectivity: The Maurepas swamp complex is the second largest continuous coastal forest in Louisiana. With the continued conversion of this habitat to marsh and open water, 18,204 acres of freshwater swamp habitat would be converted to marsh and open water. The swamp is also a valuable stopover habitat for neotropical migratory birds.

- Limiting Habitat: The LCA ARDC study area is considered habitat for bald eagles, Gulf sturgeon, and Western Indian manatee.

The Recommended Plan meets the four evaluation criteria specified in the USACE Planning and Guidance.

3.7.11.3 Acceptability

The Recommended Plan is acceptable to the State and the Federal Agencies. The Recommended Plan was selected by an interagency and interdisciplinary team.

There is broad based public support for the plan. The agencies' and public's greatest concern is beginning construction as soon as possible.

3.7.11.4 Completeness

The plan provides and accounts for all necessary investments and actions to ensure the planned restoration outputs specified in the Recommended Plan. The plan prevents the continued degradation of 1,602 acres of freshwater swamp habitat to marsh and open water over the 50-year period of analysis. Consequently, the project improves the potential for long term survival of the wetland habitat within the areas of impact.

3.7.11.5 Efficiency

The Recommended Plan was identified as cost effective by the IWR Planning Suite analysis.

3.7.11.6 Effectiveness

The plan makes a significant contribution to addressing the specific restoration problems for the swamp habitat surrounding the ARDC. Restoring hydrologic connectivity for the ecosystem will facilitate an increase in sediment and nutrient introduction to the degraded habitat and reduce impoundment. The added connectivity will also increase the flushing action, thereby reducing salinity levels. The Recommended Plan will result in an improved and sustainable ecosystem that provides benefits throughout the 50-year period of analysis of the project.

The LCA 2004 report states that, "Gapping the ARDC will allow floodwaters to introduce additional nutrients and sediment into western Maurepas Swamp. The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. This feature would provide nutrients and sediment to facilitate organic deposition in the swamp, improve biological productivity, and prevent further swamp deterioration." While the project will not stop the natural force of sea level rise and subsidence, the project will return hydrologic flow throughout the swamp habitat to its natural state, allowing for the sustainable restoration and regeneration of wetlands within the western Maurepas swamp.

3.7.12 Sustainability

Among the planning criteria utilized in the evaluation of proposed actions in ecosystem restoration projects, the significance and sustainability of ecosystem outputs achieved over the period of analysis are among the most critical. While some solutions provide immediate solutions to problems found within the project study area, the sustainability of benefits achieved leads to a continued solution to

natural and man-made causes of habitat degradation. Additionally, a sustainable solution increases the significance of the proposed action as it pertains to significant resources and local and nationwide restoration efforts. Within the LCA ARDC study area, issues such as subsidence and sea level rise provide the potential for long-term reductions in any benefits derived from a proposed action.

As stated in Section 2.3.3.3 of this report, over the 50-year period of analysis, RSLR could potentially reduce the long-term functionality and quality of the freshwater swamp habitat found within the LCA ARDC areas of impact. In order to fully ascertain the impacts of the proposed actions found in the final array of alternatives, an analysis of the sustainability of benefits within each action is required. For planning purposes, the expected benefits for the final array were calculated by the WVA model in the form of AAHUs. A full breakdown of the AAHUs achieved for the final array is found in Section 3.5.2. These benefits represent the average annual benefits observed over the period of analysis at year 50. For the low estimate of RSLR, Alternative 33 (Recommended Plan) is expected to achieve 679 AAHUs by year 50. As shown in Section 3.8, benefits in habitat units will decrease by 7 percent and 10 percent for the intermediate and high RSLR estimates, respectively. Benefits provided by the WVA model for the No-Action alternative and the Recommended Plan, in terms of non-annualized habitat units (HUs) over the 50-year period of analysis are shown in Figures 3.28 and 3.29 and Table 3.19. The net HUs achieved for each RSLR estimate are also shown.

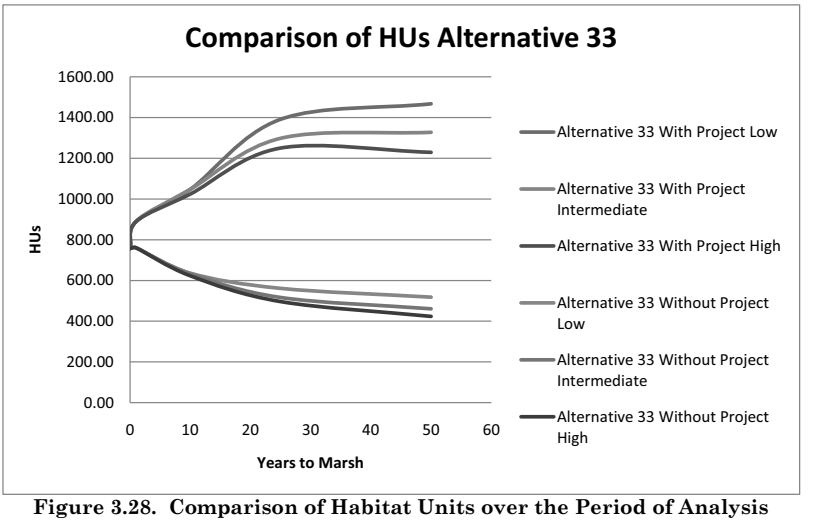


Figure 3.28. Comparison of Habitat Units over the Period of Analysis

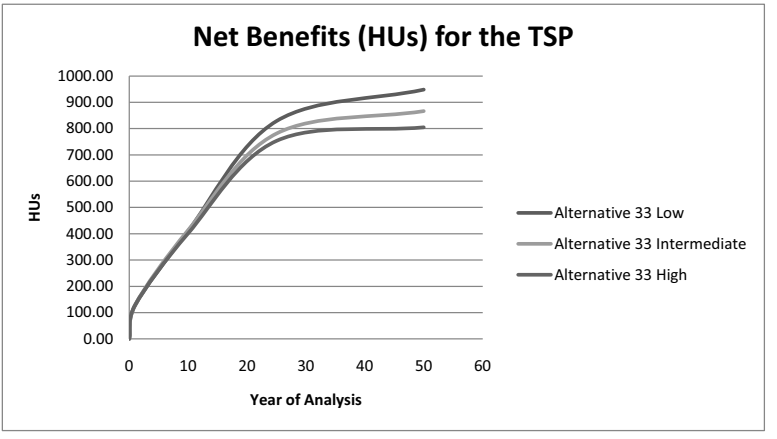


Figure 3.29. Net Benefits Obtained Over Period of Analysis

Table 3.19. Comparison of Habitat Units Obtained from the Recommended Plan Over Period of Analysis

Habitat Units Over Time for the Recommended Plan					
Alternative/RSLR Estimate	**Year of Analysis**				
	0	**1**	**10**	**25**	**50**
No-Action - Low RSLR	757	762	636	562	518
No-Action - Intermediate RSLR	757	761	634	517	461
No-Action - High RSLR	757	761	624	497	425
Alternative 33 - Low RSLR	757	889	1047	1390	1466
Alternative 33 - Intermediate RSLR	757	889	1047	1297	1327
Alternative 33 - High RSLR	757	888	1023	1249	1228
Net Benefits Achieved - Low RSLR	0	127	410	828	948
Net Benefits Achieved - Intermediate RSLR	0	128	413	780	866
Net Benefits Achieved - High RSLR	0	127	400	752	804

The results show that the impacts resulting from RSLR in general are fairly consistent for all estimates of RSLR and appear to begin near year 20 of the period of analysis. Furthermore, for all three estimates of RSLR, the amount of benefits observed appear to stabilize near year 25, with a continued, but gradual increase in

benefits over the next 25 years. This is an indicator that the proposed action achieves sustainability for the remainder of the period of analysis, with no reduction in benefits present regardless of the sea level rise scenario realized. It should also be pointed out that after 10 years, the areas of impact will achieve a net of approximately 400 HUs; this substantiates the short-term benefits resulting from the Recommended Plan as well.

The data presented in the above table and figures is representative of a freshwater swamp habitat with restored hydrologic connectivity and increased sediment and nutrient input. This results in increased seed germination, regeneration of native vegetation, and a more sustained and stable freshwater swamp. As shown in Table 3.14 vegetative, hydrologic, wildlife, and fishery resources are benefited by the implementation of the Recommended Plan. Even though RSLR could potentially impact the area over the 50-year period of analysis, benefits are observed in the short-term and maintained in the long-term frames of analysis. It should also be pointed out that accretion, which would increase with added tree growth and canopy, was not included in the analysis of RSLR. It is estimated that the net accretion rate would be 8mm/year, within the healthiest portions of the LCA ARDC study area (Bernard Wood, unpublished data, 2005 through 2009). These net accretion rates account for subsidence, but not eustatic sea level rise. Based on these estimates, accretion rates could reduce the potential impacts of sea level rise within the healthiest portions of the LCA ARDC study area, thereby adding to sustainability.

Approximately 90 percent of the total coastal wetland loss occurring in the Nation is found within Louisiana. The Maurepas Swamp complex is the second largest continuous coastal forest in Louisiana, comprising over 190,000 acres of freshwater swamp habitat. The LCA ARDC study area is an essential ecosystem since it includes wetland habitats and provides high fish and wildlife value as well as habitat for migratory birds and other aquatic organisms including threatened or endangered species. The significance of the ecosystem output plays an important role in ecosystem restoration evaluation according to section E-37 of ER 1105-2-100. The resulting ecosystem sustainability reinforces that all project objectives are achieved and maintained by implementation of the Recommended Plan. This, along with the significance of the resources benefited by this action, adds to the local and national importance of this restoration activity.

3.8 RISK AND UNCERTAINTY

Identification of all risks and uncertainties involved with development and implementation of Alternative 33 (Recommended Plan) help to develop risk management techniques and quantify cost estimate contingencies. The following risks and uncertainties are involved with development, selection, and construction of the Recommended Plan. Regardless of the associated risks, this project has been

developed to feasibility-level standards. The risks associated with the project will not impact plan selection or significantly alter the analysis of project benefits and impacts. All risk items associated with the LCA ARDC Modification project may be found in Appendix L.

Modeling Uncertainty. Models such as the WVA allow for the prediction of environmental benefits over periods of time and a range of conditions. However, they are highly dependent on input from existing data and the use of best professional judgment. The uncertainties inherent to the natural processes quantified by these models could affect the results. Relative sea level rise was determined to be the variable with the most uncertainty and therefore, could pose the greatest impact to the modeling results. In an effort to quantify these impacts, the WVA was run for all three levels of RSLR provided by EC 1165-2-211. When compared to the low sea level rise estimate, the results showed a decrease in benefits of 7 percent and 10 percent for the intermediate and high estimates, respectively. Additionally, RSLR and accretion estimates were utilized when developing the input variables for the WVA model as described in Appendix K. While the basis for RSLR and accretion are described in Section 5.2, any inaccuracies inherent to these natural processes would impact the results of the WVA model.

Cost and Schedule Risks. Cost estimates are a key component for the IWR Planning Suite analysis and in choosing a plan. Cost contingencies are included in estimations of cost to help minimize these risks. Cost contingencies are typically determined by a full Cost and Scheduling Risk Analysis (CSRA). Preliminary cost estimates for the Recommended Plan were below $40 million; therefore, a full CSRA is not required for the Recommended Plan, as stipulated in the *USACE Cost and Scheduling Risk Analysis Guidance* (ER 1110-2-1302). However, in an effort to identify the applicable cost and schedule risks inherent with implementation of the Recommended Plan, much of the process found within the USACE guidance was utilized. Once all potential areas of risk were agreed upon by the evaluation team, a Risk Register was created to help qualify and quantify the potential impacts of these risks. A Monte Carlo simulation (random occurrence generator) was run on the registry, which yielded the applicable cost contingency to use for estimating construction costs for Alternative 33 (Recommended Plan). For this study it was determined that the appropriate contingency to use is 59 percent. This cost contingency was applied to all cost accounts associated with the project except monitoring costs, which already contains a contingency cost. The application of the 59 percent contingency to the applicable accounts results in an overall project contingency of 31 percent. Due to the fact that all alternatives within the final array are composed of similar management measures and within areas similar in size and characteristics, it was determined that all risk items formulated in the CSRA would not vary for each proposed action. Additional details on the Cost Risk Analysis are found in Appendix L, Section 10.

Subsidence. Based on guidance provided in EC-1165-2-211, subsidence occurs within the LCA ARDC study area at a rate of 7.5 mm/yr. Subsidence plays a role in the occurrence of RSLR and could increase the impacts of storm surge and salinity spikes, thereby reducing any potential benefits associated with the proposed action. As shown in Section 3.7.12, upon permanent inundation, benefits would be observed throughout the 50-year period of analysis for the Recommended Plan. However, subsidence may limit benefits provided by the proposed action. Biomass accretion associated with healthy freshwater swamp habitat may offset the negative impacts resulting from subsidence and RSLR. Additional discussions on subsidence are located in Sections 2.3.3.2 and 5.2 of this report.

Sea Level Rise. Sea level rise has the ability to affect the coastal regions of the United States and Louisiana in varying degrees. The result of these potential impacts may include losses in project effectiveness, failure to achieve project objectives, and escalating operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs. Guidance provided from EC-1165-2-211 estimates these impacts as stipulated in Section 5. Specifically, within the LCA ARDC study area, sea level rise is predicted to increase from 1.5 ft (0.46 m) to 3.2 ft (0.97 m) over the 50-year period of analysis but is not expected to negate project performance or benefits. The risks associated with RSLR were considered in the formulation of all risk items during the CSRA performed for this project. The risk items in which RSLR was considered pertinent include vegetative plantings mortality and inaccuracies in the project scope (i.e., effects of RSLR may inhibit restoration opportunities available to this project).

In order to gauge the effects of RSLR on the recommended plan, the WVA model was run for Alternative 33 (Recommended Plan) and Alternative 39 (NER) over the 50-year period of analysis of the project. The impacts of the intermediate and high sea level rise estimates were added to the analysis in addition to the low estimate, which was run as the base-line condition. The results showed a decrease in benefits (AAHUs) from the low estimate of approximately seven percent when the intermediate estimate was modeled and a decrease of approximately 10 percent with the high estimate. Both alternatives displayed similar results. The results of this analysis may be seen in Table 3.20. More details on sea level rise are found in Appendix L.

Table 3.20. Effect of Relative Sea Level Rise on Alternatives

Effect of Relative Sea Level Rise on Alternatives			
Alternative	**Low SLR (AAHUs)**	**Intermediate SLR (AAHUs)**	**High SLR (AAHUs)**
33	679	640	610
34	589		
35	334		
36	1,268		
37	922		
38	1,013		
39	1,602	1,516	1,452

Additionally, the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model was run with all three estimates of RSLR for the No-Action alternative and the Future With Project conditions (conditions are nearly the same for both swamp areas). The results of these model runs are shown in Table 3.21. Results show that without the project the area will be inundated much sooner than with project conditions. The project is still expected to produce benefits even if it is inundated refer to Section 3.5.2. Additional discussions on sea level rise are located in Sections 2.3.3.3 and 4.2.2.1 of this report.

Table 3.21. Years to Permanent Inundation

RSLR Case	RSLR Year 50	No Action	With Project
Low Rate	1.5 feet	14 years	40 years
Intermediate Rate	1.9 feet	12.5 years	31 years
High Rate	3.2 feet	8 years	17 years

Accretion. Healthy freshwater swamps with an established canopy produce organic buildup, also known as biomass accretion. Accretion produces a net increase in the substrate, effectively raising the elevation of the swamp floor. It is estimated that with a healthy freshwater swamp habitat, the study area could produce 8 mm/yr of biomass accretion (Bernard Wood, unpublished data, 2005 through 2009). Accretion could help offset the effects of subsidence and RSLR, thereby reducing negative impacts and increasing the benefits associated with the proposed action. Additional discussion on biomass accretion is located in Section 5.2 of this report.

Risk of Flooding. According to the H&H modeling it was determined that all proposed actions would have an insignificant reduction in the stage on the Amite River and on the ARDC. The modeling also showed an insignificant increase in stage height within the swamp area, near the proposed openings in the ARDC dredged material berms. It has also been noted that under existing conditions, the interior swamp areas tend to flood during high stage events. The proposed plan features will not restrict flow in the ARDC or in the swamps adjacent to the ARDC. Therefore there would not be an increase in the risk of flooding within the study area. Additionally, increased flood risks would not occur for any nearby businesses and residences as a result of all proposed actions.

Geotechnical Uncertainties. Until a full geotechnical investigation is performed in the PED phase of the project, uncertainties will exist with the assumptions made regarding material placement and slope stability. It is assumed that when material from excavation is placed within the project area, it will be stable enough to create habitat at an elevation sufficient to sustain bottomland hardwood tree species. However, if the material does not maintain the required elevations, a shift in the tree species to be utilized for these plantings will be made to those suitable for a freshwater swamp. Additionally, the stability of channel and placement area slopes will not be known until the full results of a slope stability analysis are completed.

Assumptions. The following assumptions are key to the success of the project:

- The rainfall-driven conditions of the Amite River watershed will remain unchanged; therefore, the hydrologic cycles within the ARDC will also remain unchanged. The current trend suggests conditions will remain unchanged.
- The net effects of local subsidence and sea level rise will not deviate significantly from the numbers estimated for this study. This is based on hydraulic and habitat conditions.
- The conveyance channels would be naturally altered over time but would remain functional, eventually reaching a state of hydrologic stability. This is based on existing natural channels in the study area which have formed under similar conditions.

3.9 IMPLEMENTATION REQUIREMENTS

3.9.1 Schedule

The approximate LCA ARDC milestone schedule for project implementation is shown in Table 3.22. A favorable signed Chief's Report is required by December 31, 2010 to obtain authorized construction funding.

Table 3.22. LCA ARDC Milestone Schedule

Milestone	Baseline Date
Final Report	August 2010
Division Engineers Notice	August 2010
Washington Level Reviews	August 2010
State and Agency Review	October 2010
Sign Chief's Report	December 2010
ASA(CW) and OMB Review	2011
ASA(CW) Reports to Congress	2011

The remaining requirements for the LCA ARDC FS/SEIS, and modification project implementation schedule are shown in Table 3.23. Design Considerations were previously discussed in Section 3.7.2.

Table 3.23. LCA ARDC Modification Project Implementation Schedule

Milestone	Baseline Date
Begin Pre Construction Engineering and Design	2010
Initiation of Monitoring Program	2010
USACE and non-Federal sponsor negotiate PPA	2012
Complete Plans and Specifications	2012
Real Estate Acquisition	2012
Award Contract	2012
Construction Start	2012
Complete Construction- Earthwork	2012
Complete 1st Vegetation Planting	2015
Complete 2nd Vegetation Planting	2018
Turnover Project to Local Sponsor	2018
Complete Monitoring Program	2023

3.9.2 Implementation Responsibilities

This project was authorized for construction by the Water Resources Development Act of 2007, contingent upon a signed Chief of Engineers Report by December 31, 2010. After a signed Chief's report, this project would be eligible for construction funding. The project would be considered for inclusion in the President's budget based on national priorities, magnitude of the Federal commitment, economic and environmental feasibility, amount of local public support, willingness of the non-Federal sponsor to fund its share of the project cost, and the budget constraints that may exist at the time of funding. Once Congress appropriates Federal construction funds, the Corps and the non-Federal sponsor would enter into a project partnership agreement (PPA). This PPA would define the Federal and non-Federal responsibilities for implementing, operating, and maintaining the project. The project is expected to begin Pre construction Engineering and Design in late 2010 and begin construction in 2012 (see Table 3.22).

The Corps would officially request the sponsor to acquire the necessary real estate immediately after signing the PPA. The advertisement of the construction contract would follow the certification of the real estate. After construction, the Corps' acceptance from the contractor and notice of construction completion of the project (or a functional portion of the project) to the non-Federal sponsor would proceed or be concurrent with the delivery of an O&M manual and as-built drawings. The estimated schedule for project construction is shown in Table 3.23.

The non-Federal sponsor shall, prior to implementation, agree to perform all of the local cooperation requirements and non-Federal obligations. Local cooperation requirements and non-Federal sponsor obligations include, but are not necessarily limited to:

a. Provide a minimum of 35 percent of total project costs as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project partnership agreement, 25 percent of design costs;

(2) Provide, during the first year of construction, any additional funds needed to cover the non-Federal share of design costs;

(3) Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material that the Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;

(4) Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of the total project costs allocated to the project;

b. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project;

c. Not use funds provided by a Federal agency under any other Federal program, to satisfy, in whole or in part, the non-Federal share of the cost of the project unless the Federal agency that provides the funds determines that the funds are authorized to be used to carry out the study or project;

d. Not use project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project;

e. For as long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the project, or functional portions of the project, including mitigation, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal Government;

f. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the non-Federal sponsor of responsibility to meet the non-Federal sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

g. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

h. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

i. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any

CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

j. Agree that, as between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that would not cause liability to arise under CERCLA;

k. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstruction or encroachments) which might reduce ecosystem restoration benefits, hinder operation and maintenance, or interfere with the project's proper function, such as any new developments on project lands or the addition of facilities which would degrade the benefits of the project;

l. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as would properly reflect total costs of construction of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

m. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

n. Comply with all applicable Federal and state laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards and requirements, including but not limited to 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying, and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.); and

o. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for the

initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

3.9.3 Cost Sharing

The State of Louisiana, acting through the Coastal Protection and Restoration Authority of Louisiana (CPRA), will be the non-Federal sponsor for the LCA Amite River Diversion Canal Modification Project. In November 2008, the USACE and CPRA executed a single Feasibility Cost-Share Agreement covering six Louisiana Coastal Area near-term plan elements listed in Section 7006(e) of the Water Resources Development Act of 2007. The six features each underwent a separate feasibility analysis and environmental compliance analysis culminating in a single master feasibility document. The cost-share during the feasibility phase was 50 percent Federal and 50 percent non-Federal. However, the individual elements have been divided so that each entity had lead responsibility for preparing three of the six report components. At the end of the feasibility phase the total cost for all elements will have been shared on a 50/50 basis, yet for work on each individual element during the feasibility phase the ratio of funds expended by either the Federal or non-Federal sponsor will be higher depending upon their level of responsibility. CPRA had the technical planning lead for this particular LCA project element.

Following the feasibility phase, the cost share for the planning, design and construction of the project will be 65 percent Federal and 35 percent non-Federal. The CPRA must provide all lands, easements, rights-of-way, utility or public facility relocations, and disposal areas (LERRDs) required for the project. Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) of the project would be a 100 percent CPRA responsibility.

Table 3.24 shows the cost apportionment for the Recommended Plan.

Table 3.24. Cost Apportionment for the Recommended Plan

Item	Federal	Non-Federal	Total
Construction	$3,070,000	$1,380,000	$4,450,000
S&A	$261,000	$140,000	$401,000
PED	$347,000	$187,000	$534,000
LERDDs	$0	$180,000	$180,000
Monitoring	$1,930,000	$1,040,000	$2,970,000
Total*	$5,610,000	$2,930,000	$8,540,000

S&A – Supervision and Administration (Construction Management).
PED – Planning, Engineering, and Design.
LERRD – Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas.
* Fully funded cost estimate includes interest during construction.

Additionally, project monitoring and any Adaptive Management deemed necessary will be cost shared at 65/35 for the first 10 years of the period of analysis.

Under current law, authority for the non-Federal sponsor to receive credit for construction activities is limited. Section 7007(a) of WRDA 2007 authorizes the Secretary to credit, "toward the non-Federal share of the cost of a study or project under this title the cost of work carried out in the coastal Louisiana ecosystem by the non-Federal interest for the project before the date of the execution of the partnership agreement for the study or project." In addition, section 7007(a) incorporates the requirement of section 221 of the Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) that the Government and non-Federal sponsor must enter into a separate agreement for any work that will be carried out prior to execution of the partnership agreement. In other words, work undertaken by the non-Federal sponsor prior to (but not after) execution of the project partnership agreement (PPA) is eligible for credit subject to execution of a separate agreement covering such work before it is undertaken. For design work that the non-Federal sponsor proposes to undertake, the Design Agreement will serve as the required separate agreement. For construction work that the non-Federal sponsor proposes to undertake, an In-Kind Memorandum of Understanding will be required. Opportunities to enter into an In-Kind MOU for construction activities will depend on the schedule for entering into the PPA for a project.

Section 7007(d) provides that credit afforded under section 7007 that is in "excess" of the non-Federal cost share for a study or project authorized in Title VII of the Water Resources Development Act of 2007 may be applied toward the non-Federal cost share of any other study or project under that title. "Excess" credit will be applied only toward another study or project involving the same sponsor. In addition, "excess" credit will be applied within project phases (i.e., study to study, design to design, and construction to construction). At this time, it is anticipated

that that there are limited opportunities for the application of "excess credit" from other Title VII projects toward these projects.

3.9.4 Environmental Commitments

The USACE, non-Federal sponsor, and all contractors would commit to following all laws and executive order, and to avoid and minimize adverse impacts to the environment by the following:

- Employ necessary Best Management Practices (BMPs) to reduce erosion and sedimentation during construction. The Plans and Specifications would include such BMPs and erosion control measures as necessary. The Contractor would be required to develop a Storm Water Pollution Prevention Plan (SWPPP) that would be coordinated through the Louisiana Department of Environmental Quality (LDEQ).
- The Contractor would be made aware of any practices or measures need to be compliant with the Endangered Species Act (ESA).
- The Contractor would be made aware of any practices or measures to protect cultural resources.
- The USACE and the non-Federal Sponsor agree to maintain coordination with the U.S. Fish and Wildlife Service (USFWS) and the LDEQ to ensure compliance with all laws and executive orders.

The Contractor would be prohibited from dumping oil, fuel, or other hazardous substances and would require that all appropriate sanitation measures are followed. The Contractor would be to develop a Spill Prevention Control and Countermeasure plan (SPCC).

3.9.5 Financial Requirements

It is expected that the CPRA will have the capacity to provide the required local cooperation for the Recommended Plan. A project schedule and cost estimate will be provided to the CPRA so that it may develop a financing plan. A financial analysis will be conducted to assess the CPRA's capability to financially participate in the Recommended Plan. A standard cost share percentage of 65 percent Federal and 35 percent non-Federal would be applied to the total first cost of the project. The 35 percent share of the project cost includes the State of Louisiana's responsibility for providing all LERRDs.

Section 7007(b) of WRDA 2007 provides that "The non-Federal interest may use, and the Secretary shall accept, funds provided by a Federal agency under any other Federal program, to satisfy, in whole or part, the non-Federal share of the cost of the study or project if the Federal agency that provides the funds determines that the funds are authorized to carry out the study or project." If the Mineral

Management Services determines in writing that funds it provides to the non-Federal sponsor under the Energy Policy Act of 2005 (Coastal Impact Assistance Program - CIAP) and the Gulf of Mexico Energy Security Act of 2006 (GOMESA) are authorized to be used to carry out the ARDC project, the non-Federal sponsor can use those funds toward satisfying its local cooperation for the project, including the non-Federal sponsor's acquisition of LERRDs required for the project. By letters dated July 2, 2009 and December 18, 2009, the Minerals Management Service and the USACE established a process for the Minerals Management Service to provide its written determination regarding the acceptability of the use of CIAP funds for LCA studies, projects, and programs. That process provides that the Minerals Management Services' written determination for a specific study, project, or program will take the form of the grant award document for that activity.

3.9.6 Views of Non-Federal Sponsor

As demonstrated in its August 9, 2010 letter of support for the LCA6, (Attachment 1) CPRA, the non-federal sponsor, has expressed the desire for implementing the LCA Amite River Diversion Canal Modification project and sponsoring the project construction in accordance with the items of local cooperation that are set forth in the recommendations chapter of this report. In addition, CPRA supports the NER plan (Alternative 39) since this plan includes all of the most critical areas within the Maurepas Swamp basin, establishes the greatest amount of hydrologic connectivity of all of the alternatives, is cost-effective while providing the most benefits, and is a best-buy plan. However, due to authorized cost limitations in WRDA 2007, CPRA supports Alternative 33 as the Recommended Plan. CPRA believes the project warrants additional Congressional authorization to increase funding and allow the implementation of the NER plan (Alternative 39) to fully address the Maurepas Swamp's ecosystem needs identified in this report.

The State of Louisiana fully supports the project. The state recognizes that the USACE's position is that section 7007 does not authorize credit for work carried out after the date of a partnership agreement. However, the state disagrees with the USACE position and intends to continue to seek a change in law that would allow in-kind contribution credit for work carried out after the date of a Project Partnership Agreement and that would allow for such in-kind contributions credit to carry over between LCA Program components (i.e., "excess" credit for work undertaken after signing of the project partnership agreement for one project may be carried over for credit to another project). Nevertheless, while the state is of the opinion that its view is consistent with the authority and Congressional intent under WRDA 2007, the state fully intends to proceed with the project under the Corps' interpretation of current law and to meet all non-Federal financial and other obligations outlined by the USACE in this report until such time as the law is changed.

4.0 AFFECTED ENVIRONMENT

4.1 ENVIRONMENTAL SETTING OF THE STUDY AREA

This section describes the climate, geomorphic and physiographic setting, and the historic and existing conditions for the following important resources: soils and waterbottoms, coastal vegetation, wildlife, fisheries, plankton, benthos, essential fish habitat (EFH), threatened and endangered species (T&E), hydrology (including flow and water levels, and sedimentation), water quality, recreation, cultural and historic resources, aesthetics, air quality, socioeconomic and human resources (including population, infrastructure, employment and income, navigation, oil and gas resources, utilities, pipelines, commercial fisheries, oyster leases, flood control, and hurricane protection), noise and Hazardous and Toxic and Radioactive Wastes (HTRW).

A resource is considered important if it is recognized by statutory authorities including laws, regulations, Executive Orders (EO), policies, rules, or guidance; if it is recognized as important by some segment of the general public; or if it is determined to be important based on technical or scientific criteria. The following sections discuss historic and existing conditions of each important resource occurring within the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) study area.

4.1.1 Location

The LCA ARDC study area (Figures 1.2 and 1.3) is located along the ARDC in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal.

4.1.2 Climate

The climate of the study area is subtropical marine with long humid summers and short moderate winters. The climate is strongly influenced by the water surface of many sounds, bays, lakes and the Gulf of Mexico and seasonal changes in atmospheric circulation. During the fall and winter, the study area experiences cold continental air masses which produce frontal passages with temperature drops. During the spring and summer, the study area experiences tropical air masses which produce a warm, moist airflow conducive to thunderstorm development (LACPR, 2009). The study area is also subject to periods of both drought and flood, and the climate rarely seems to truly exhibit “average” conditions.

The study area is susceptible to tropical waves, tropical depressions, tropical storms, and hurricanes. These weather systems can cause considerable property and environmental damage and loss of human life. Historical data from 1899 to 2007 indicate that 30 hurricanes and 41 tropical storms have made landfall along the Louisiana coastline (NOAA, 2009). The largest recent hurricanes were Katrina and Rita in 2005, which caused extensive devastation in south Louisiana and some damage in the study area. Hurricane Gustav, while much smaller and less intense, caused additional damage in the study area in 2008. Hurricane Ike, which made landfall in Galveston, Texas in 2008, caused flooding and wind damage in coastal areas as it passed the LA Coast.

The 1955 USACE *Survey of Amite River and Tributaries, Louisiana* provides historical climate and meteorological data for the lower Amite River Basin, which includes the study area. Average minimum and maximum temperatures and rainfall, over the period of record (POR), is provided in the survey. The minimum and maximum temperatures from 1901 through 1953 for Reserve, Louisiana, located 10 miles from the study area, are 15 and 100 degrees Fahrenheit, respectively. The average temperature for the same POR is 70 degrees Fahrenheit. The survey also identified 10 rainfall stations in the lower Amite River Basin (a subset of the temperature stations with approximately the same PORs), also ranging from 10 to 70 miles from the study area. Minimum and maximum annual rainfall values for Reserve were reported as 34.1 and 84.3 inches, respectively. The average rainfall for Reserve during the same POR was 61.6 inches.

4.1.3 Geomorphic and Physiographic Setting

The geomorphic and physiographic setting is technically significant because geologic conditions can place constraints on the nature, design, or location of the proposed action, as well as determine the impacts that the proposed action would have on other important resources.

The study area is located in the Maurepas Basin, a component of the Lake Pontchartrain Basin, which is located near the southern terminus of the Mississippi Alluvial Plain physical province. The most significant geologic features in the basin are Lakes Maurepas and Pontchartrain. These lakes occupy a portion of the St. Bernard Delta complex, one of the oldest deltaic complexes within the Mississippi Deltaic Plain Region. The St. Bernard Delta complex formed in what was then Pontchartrain Bay, enclosing a portion of the bay to form Lake Pontchartrain. The Open-File Report 98-36 (1998) describes the St. Bernard Delta complex as a distinct physiographic unit, formed by Mississippi River deposits between 700 and 4,700 years ago. The majority of the remaining surface features within the St. Bernard Delta complex are comprised of inland swamp, tidal channels, shallow lakes and bays, natural levee ridges along active and abandoned distributaries, sandy barrier islands, and beaches.

The St. Bernard Delta complex began receiving Mississippi River deltaic sediments from the middle to late Holocene. The first deltaic deposits to enter the area were homogenous prodelta clays. This was followed by the deposition of interdistributary bay deposits as the Mississippi River and its distributaries prograded. The deposits were finer sediments (silty clay and clay) that were transported away from the distributary channel and settled out of suspension as interdistributary deposits.

Holocene deposits in the St. Bernard Delta complex typically overlay Pleistocene alluvial terrace deposits of fine grained sands and silts derived from alluvium deposited by the proto-Mississippi and other coastal river systems during recent sea level lowstand intervals. Holocene and Pleistocene deposits are underlain by approximately 34,000 feet (ft) of sediment and sedimentary rock. Sandstone, siltstone, and claystone account for virtually all the sedimentary rocks. These sediments record the outward progression of the Gulf Coastal Plain, and in the case of Pleistocene sediments, the outward building of the Mississippi and proto-Mississippi River Complex.

Construction of the Amite River and Tributaries (1956) flood control project, which includes the ARDC, has impacted the natural geomorphology and hydrology of the St. Bernard Delta complex. Hydrologic analyses within the study area indicate that the ARDC and its associated dredged material berms have hydrologically isolated the study area, thereby preventing the adjacent bald cypress-tupelo swamp habitat from receiving nutrient and sediment-laden floodwaters during high channel flow events and have prevented the adjacent swamps from draining during low channel flow events in the lower Amite River system. Further details behind the geomorphic setting related to the LCA ARDC project are located in Appendix L of the report. Additionally, biomass accretion rates are discussed in Sections 2.3.3.2 and 5.2 of the report.

4.2 SIGNIFICANT RESOURCES

4.2.1 Soils and Waterbottoms

Soils are institutionally significant because of the Center for Environmental Quality memorandum of August 11, 1980, entitled "Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act (NEPA);" EO 11990 – Protection of Wetlands; and Agriculture and Food Act of 1981 (Public Law 97-98) containing the Farmland Protection Policy Act (FPPA) (Public Law 97-98; United States Code [U.S.C.] 4201 *et seq*.). This resource is technically significant because it is a critical element of coastal habitats, supports vegetation growth and benthic productivity, and influences the types of land use within a given area. This resource is publicly significant because of the high value the public places on wildlife and fisheries supported by the soils in the area.

Soils and waterbottoms are institutionally significant because of the NEPA of 1969; the Coastal Zone Management Act; and the Estuary Protection Act. They are technically significant because the bottom of an estuary regulates or modifies most physical, chemical, geological, and biological processes throughout the entire estuarine system via what is called a "benthic effect." Benthic animals are directly or indirectly involved in most physical and chemical processes that occur in estuaries (Day *et al*., 1989). Waterbottoms are publicly significant because of their habitat value to members of the epibenthic community (e.g., oysters, mussels, etc.) that utilize estuarine waterbottoms and provide commercial and recreational fisheries.

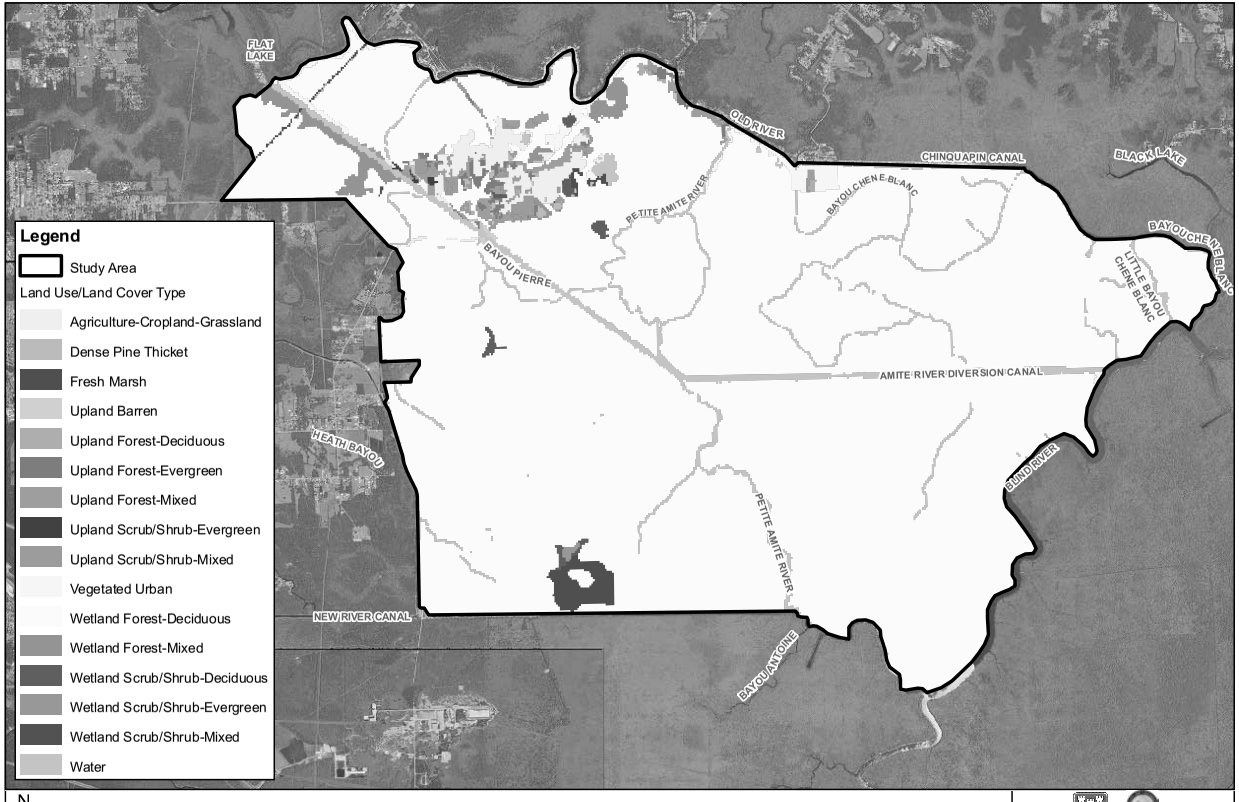
4.2.1.1 Soils

Deltaic processes have played a significant role in the types of soil present in the LCA ARDC study area. The dynamic and episodic deltaic building processes alternate between periods of seaward progradation of deltas (regressive deposition) and the subsequent landward retreat of deltaic headlands as deltas are abandoned, reworked, and submerged by marine waters (transgressive deposition). The types of soils present today in much of the LCA ARDC study area are characterized by the depositional environments associated with both phases of the deltaic cycle.

Historic Conditions. There has been a conversion of 1,600 acres of freshwater swamp habitat to marsh and open water in the Amite and Blind River mapping units between 1932 and 1990 (Louisiana Coastal Wetlands Conservation and Restoration Task Force [LCWCRTF] and Wetland Conservation and Restoration Authority [WCRA], 1999).

Existing Conditions. National Resource Council (NRC) data indicate that 19 soil types are found within the LCA ARDC study area (Figures 4.1 and 4.2, Natural Resources Conservation Service [NRCS], 1976, 1991). Soils within the LCA ARDC study area are typically hydric clays or mucks that are frequently or continuously flooded (NRCS, 1976, 1971). Soils in the Barbary series comprise a majority (62 percent) within the LCA ARDC study area, and substantial quantities of soils within the Maurepas series (12 percent) are also present.

Soil loss is continuing due to natural and man-made causes, particularly in the Barbary, Fausse, and Maurepas soils. As a result, swamp and wetland forests have deteriorated and become increasingly stressed. Die back of the swamp vegetation has contributed to the conversion to freshwater marsh. As marsh fragments, small islands of floating marsh can develop. Floating marsh (flotant) is vulnerable to degradation and is considered the most fragile, with respect to catastrophic storm events, of all marsh types. Due to degradation and decreased productivity, soil accretion is insufficient to offset regional subsidence and the degraded swamp habitat is consequently susceptible to conversion to fresh marsh or

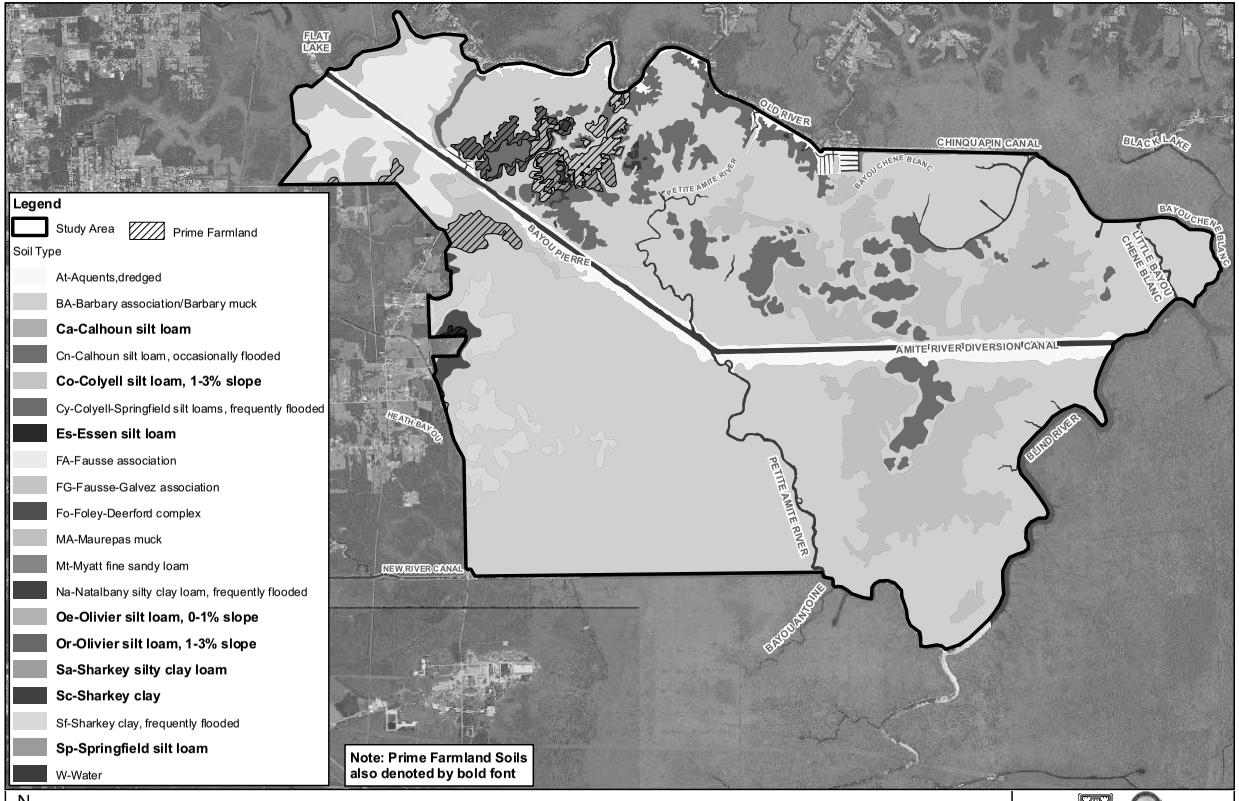


LAND USE/LAND COVER MAP

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Land Use/Land Cover Data: USGS Louisiana Gap Analysis Project, 1998
Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 4.1
Date: November 2009
Scale: 1:85,000
Source: USDA/USGS/GEC
Map ID: 27850108-1849



SOILS MAP

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 4.2
Date: November 2009
Scale: 1:90,000
Source: USDA/NRCS/GEC
Map ID: 27850108-1848

open water. According to guidance form EC-1165-2-211, the subsidence rate for the project area has been calculated to be 7.5 mm/yr (USACE 2009).

Prime and Unique Farmlands. In an effort to identify the extent and location of important farmlands, NRCS, in cooperation with other interested Federal, state, and local government organizations, has inventoried land that can be used for the production of the nation's food supply. The United States Department of Agriculture (USDA) defines *prime farmland* soil as land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops that is available for these uses. Prime farmland generally has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks (USDA 2006). Some soils identified as prime farmland require measures that overcome hazards or limitations such as flooding or excess wetness or drought.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables (USDA NRCS, 1993). It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria, and commonly occurs in areas where there is a special microclimate. *Additional Farmlands of statewide importance* nearly meet the criteria for prime farmland, and economically produce high crop yields when treated and managed according to acceptable farming methods.

A recent trend in land use in some areas has been the loss of prime farmland to industrial and urban areas. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, susceptible to drought, less productive, and cannot be easily cultivated. As a result of a substantial decrease in the amount of open farmland, the FPPA was put forth by Congress. In the statement of purpose, Federal programs which contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses would be minimized. It follows that Federal programs shall be administered in a manner that, as practicable, would be compatible with state, local government, and private programs and policies to protect farmland.

Eight soils within the LCA ARDC study area are classified as prime farmland. These soils (Calhoun silt loam; Colyell silt loam; Essen silt loam; Olivier silt loam, 0-1 percent slopes; Olivier silt loam, 1-3 percent slopes; Sharkey silty clay loam; Sharkey clay; Springfield silt loam) comprise a total of approximately 749

acres (three percent) of soils within the LCA ARDC study area (See Figure 4.2). Prime farmland soils within the LCA ARDC study area are generally confined to agricultural areas in the vicinity of LA Highway 22 (LA-22).

4.2.1.2 Waterbottoms

Historic Conditions. Historically, swamp waterbottoms in the LCA ARDC study area were typically subjected to flooding and drying events. Construction of the ARDC (1956) and the Chinquapin Canal (constructed in the early 1960s) increased the amount of available waterbottoms. However, sidecast of the dredged material from constructing the ARDC and Chinquapin canal has restricted hydrologic connectivity thereby impounding and permanently flooding large portions of the swamp habitats in the LCA ARDC study area.

Swamps have been shown at times to be both sources and sinks of nutrients, particularly nitrogen. Phosphorus, however, is typically the limiting nutrient which is attributed to excessive algal growth (blooms). Little phosphorus appears to be retained in swamp vegetation, but instead is retained in the sediments. As long as sediment mobilization remains low, phosphorus export should remain low (Mitsch and Gosselink, 2000). Nitrogen is largely reduced by denitrification, but can also undergo substantial reductions via burial in subsiding sediments (Lane *et al.*, 2003). According to Mitsch and Gosselink (2000), organic matter is utilized primarily through detrital pathways, but decomposition can be impeded by anaerobic conditions. Mitsch and Gosselink (2000) point out that little detritus material is exported from the still water or slow-flowing swamps. However, detritus export can be significant from lake edge and river swamps.

Existing Conditions. Waterbottoms in the LCA ARDC study area are associated with the existing waterways and channels, including the ARDC, bayous, canals, and creeks, and are also in open water areas within the swamp. Portions of the swamp are impounded by dredged material berms along the ARDC and maintain higher-than-normal water levels.

4.2.2 Hydrology

This resource is institutionally significant because of NEPA; Clean Water Act (CWA); Flood Control Act of 1944; Coastal Barrier Resources Act; Rivers and Harbors Act of 1899; River and Harbor and Flood Control Act of 1970; Watershed Protection and Flood Prevention Act; Submerged Land Act; Coastal Zone Management Act; Safe Drinking Water Act; Estuary Protection Act; Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and EO 11988 Floodplain Management. This resource is technically significant because civil works water resources development projects typically impact (positively or negatively) the

interrelationships and interactions between water and its environment. This resource is publicly significant because the public demands clean water, hazard-free navigation, and protection of estuaries and floodplains.

The LCA ARDC study area is located within the Pontchartrain Basin, a 9,700-square-mile drainage basin in southeastern LA. Three major estuarine lakes, Lakes Maurepas, Pontchartrain, and Borgne, each form a subbasin of the greater Pontchartrain Basin. The LCA ARDC study area is located within the Maurepas subbasin and the Amite River and Blind River watersheds. The combined Amite River and Blind River watersheds are approximately 2,200 square miles. Most of the LCA ARDC study area is in the Blind River watershed and most of this watershed is the Lake Maurepas swamp. Storm water runoff in the LCA ARDC study area is dominated by the Amite River. The Amite River watershed is approximately 1,842 square miles and a third of this watershed is in the State of Mississippi. Additionally, the LCA ARDC study area is hydrologically independent of the LCA Small Diversion at Convent/Blind River study area.

4.2.2.1 Flow and Water Levels

Historic Conditions. Historically, hydrology within the LCA ARDC study area was dominated by overbank flows from the Mississippi and Amite Rivers. The construction of flood control projects, most notably the AR&T (1956) project, which includes the ARDC, largely isolated bald cypress-tupelo swamp habitat within the LCA ARDC study area from natural waterbodies and effectively ended overbank flooding from the Mississippi and Amite Rivers. The LCA ARDC study area is a rural and relatively lightly inhabited coastal wetland forest area that contains potable water resources. Sources of fresh groundwater in the LCA ARDC study area and vicinity include the Chicot Equivalent Aquifer, the Evangeline Equivalent Aquifer, and the Jasper Equivalent Aquifer.

Historically, hydrologic conditions within the LCA ARDC study area were dominated in the north and west by the Amite River, in the south by overbank flow from the Mississippi River, and in the east by tidal influence from Lake Maurepas. Periodic flooding of the Amite River and/or Mississippi River resulted in the inundation of the LCA ARDC study area. Flooding occurred annually, with peak water elevations in the late spring or early summer. As floodwaters receded, surface waters in the LCA ARDC study area were conveyed eastward via sheet flow until they were received by Bayou Chene Blanc or the Blind River, by which they were conveyed to Lake Maurepas. Further hydrology and hydraulic information is provided in Appendix L.

Implementation of flood control projects, beginning in the early 19th century and culminating in the Mississippi River and Tributaries (MR&T) (1928) and AR&T (1956) Federal flood control projects disrupted the natural hydrologic

regime within the LCA ARDC study area. River channelization and levee construction reduced overbank flooding in the LCA ARDC study area, which in turn reduced the influx of floodwaters bearing high volumes of nutrients and sediment that are essential for biomass production and soil accretion. Additionally, the placement of dredged material along either side of the ARDC disrupted sheet flow within the LCA ARDC study area and prevented the drainage of the swamp during intervals of low surface flow (Shaffer *et al.*, 2006). These dredged material berms, in conjunction with other constructed improvements, such as the relict railroad grade that crosses the eastern LCA ARDC study area from north to south, permanently impounded some of the swamps within the LCA ARDC study area.

Sea level Rise. Eustatic sea level refers to the global fluctuations in sea level primarily due to changes in the volume of major ice caps and glaciers, and expansion or contraction of seawater in response to temperature changes. Past studies based on worldwide tide gauges estimate the rate of eustatic sea level rise at 1.2 mm/yr (Gornitz *et al.*, 1982). Additional studies have estimated between 3 to 5 mm/yr (Penland *et al.*, 1990). More recent studies have predicted an increase in this rate to 1.7 mm/yr for the next 100 years due to climate change (EC 1165-2-211).

The entire Louisiana coastal zone is experiencing relative sea level rise, the net effect of eustatic sea level rise coupled with numerous processes that result in a downward movement of the land surface relative to sea level. Vertical land movement along the Louisiana coast is controlled by several major factors, including compaction and faulting. Past studies have indicated a relative sea level rise rate from 5 to 9 mm/yr within the Maurepas Swamp area (Penland *et al.*, 1990).

In addition to eustatic sea level rise, EC 1165-2-211 provides procedures for incorporating vertical land movement into the analysis. Relative sea level rise (RSLR) is obtained by incorporating the eustatic sea level rise with vertical land movement. A historic rate considered to be representative of the LCA ARDC study area is calculated using the West End at Lake Pontchartrain gage (85625). Daily stage data over the period 1959 to 2009 indicate a rate of 9.20 mm/yr (0.0302 ft/yr; see Figure 4.3). The standard error of the linear trend line is 0.65 ft.

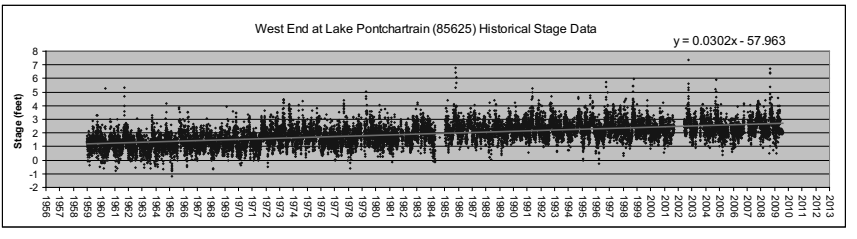


Figure 4.3. Plot of Historic Rate from Daily Stage Data

Existing Conditions. The LCA ARDC study area is located within the Lake Maurepas watershed of the Pontchartrain Basin. The principal hydrologic influence on the basin is that of Lake Maurepas. Surface water flow within the basin is generally from west to east to Lake Maurepas during most normal conditions. However, strong east winds can push water from Lakes Pontchartrain and Maurepas into the Lower Amite River system (Hsu *et al.,* 1997**)**. Principal surface flow conduits in the LCA ARDC study area include the ARDC, the Amite and Petite Amite Rivers, and Blind River, into which the flow from other waterbodies is ultimately received and conveyed to Lake Maurepas. From Lake Maurepas surface waters are conveyed eastward through Pass Manchac, North Pass, or gaps in the Manchac Land Bridge to Lake Pontchartrain, from which they are conveyed eastward to the Gulf of Mexico via Chef Menteur Pass or the Rigolets and Lake Borgne.

Hydrologic flow patterns in the southwestern Maurepas Swamp were modeled in support of Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Project PO-29, *Mississippi River Reintroduction into Maurepas Swamp* (Day *et al.*, 2004; URS, 2007). Physical hydraulic and hydrologic processes in the Maurepas Swamp, including channel flow, propagation of tidal signals, overbank flow, flow through bank gaps, and swamp circulation, were assessed under a variety of conditions during this modeling effort. The results of these investigations indicate that Lake Maurepas exerts a significant influence on stage levels within the lower Amite River and Blind River systems.

The swamp habitat along the left descending bank of the ARDC in subunits NE-1 and NE-2 is impounded (Shaffer *et al.*, 2006) (Figure 4.4). Figure 4.5 presents water surface elevation for a gages within NE-1, NE-2, along with three USGS gauges located within or near the study area. A map depicting the location of these gauges may be found in the H&H report in Appendix L, Section 2, Figure 2.2 of this report. During the study period, water levels within this area never receded below 2.2 ft above sea level; even during periods in which water levels within the canal receded below this level.

Within the eastern portion of the LCA ARDC study area, the swamps adjacent to the right descending bank of the ARDC exhibit a lack of hydrologic connectivity as well. The resulting lack of water flow between the ARDC and the adjacent swamp inhibits the exchange of sediments and nutrients within the swamp, which is vital to tree regeneration and growth.

Swamp impoundment does not appear to occur in the western portion of the LCA ARDC study area. Numerous drainage culverts were observed within the dredged material berms in these areas during field investigations, particularly in the portions of the LCA ARDC study area located in Ascension Parish. Additionally, several small gaps were constructed in the dredged material berms in

this area, and the confluence of Bayou Pierre with the ARDC provides additional hydrologic exchange between the ARDC and the adjacent swamp. Most of these hydrologic conduits are located northwest of the LA Highway 22 Bridge.

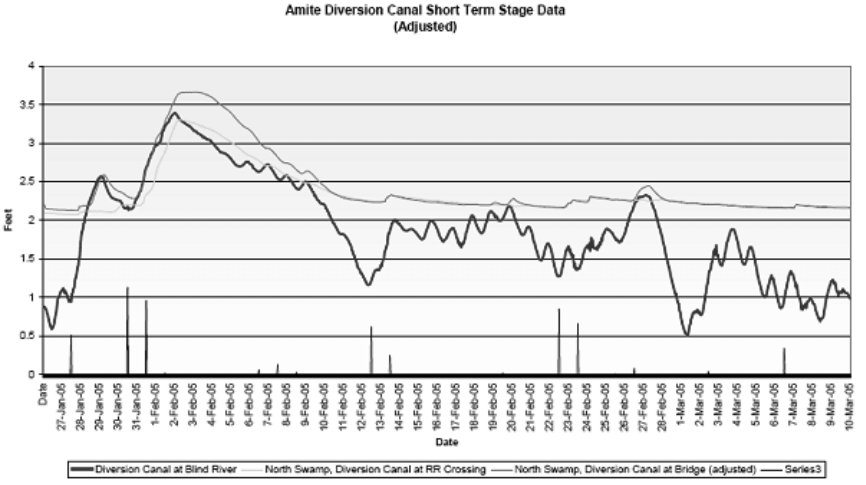


Figure 4.4. Hydrograph of Water Levels Obtained from Louisiana Department of Natural Resources (LDNR) Gauges in the LCA ARDC Study Area (Source: Shaffer *et al.,* [2006])

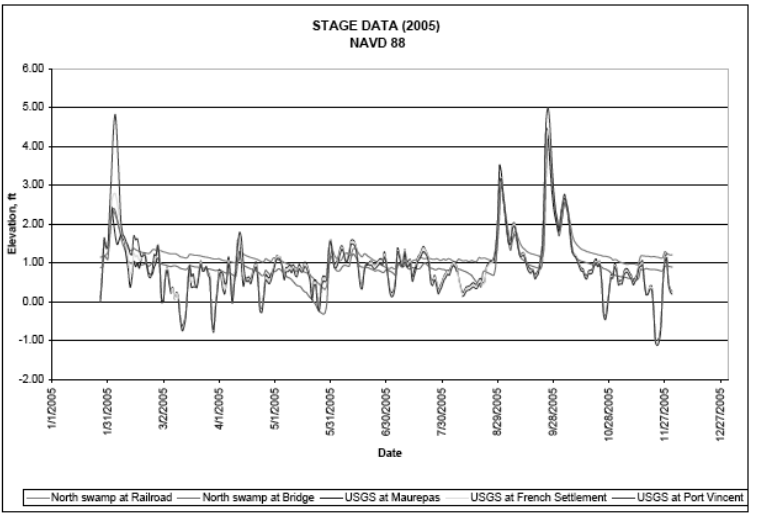


Figure 4.5. Water Surface Elevations at the North Swamp at the Railroad Grade and North Swamp at the Bridge in North American Vertical Datum (NAVD) 88(2006.81) and Three U.S. Geological Survey (USGS) Gauges

4.2.2.2 Sedimentation and Erosion

Sediment quality is defined as the suitability of the habitat for supporting designated uses, including, but not limited to, benthic fauna and emergent wetland plants. Storm events, flowing water, and other factors can potentially re-mobilize sediments (Louisiana Department of Environmental Quality [LDEQ], 2007). Aquatic sediments are essential in maintaining the structure (assemblage of organisms) and function (processes) of aquatic ecosystems (LDEQ, 2007). Sediment quality is significant because sediments support community productivity (LDEQ, 2007). The productivity of green plants, algae, and bacteria build the foundation of food webs upon which higher aquatic organisms depend. Sediments provide essential habitats for epibenthic (live on sediments) and infaunal (live in sediments) invertebrates and demersal fish, which represent important food sources for amphibians, reptiles, fish, birds, and mammals (LDEQ, 2007). Additionally, many fish and amphibian species utilize sediments at stages in their life cycles for the purposes of spawning, incubation, refuge, and over-wintering (LDEQ, 2007).

Historic Conditions. In addition to contributions from erosion and tropical storms, the Amite River is, and the Mississippi River and the Amite River were, the primary sources of sediment input into waterbodies within the LCA ARDC study area. The northern 30 miles of the Amite River in Louisiana, i.e., from the Mississippi state line to LA hwy 37 in Grangeville, is recognized as one of 15 waterbodies impaired by excess sediments in Louisiana (LDEQ, 2006). Fish and wildlife habitat has been directly degraded with significant loss of shoreline and aquatic habitat in this reach. This degradation is believed to have been caused by urbanization, sand and gravel mining, erosion, shallower water, faster flow, higher water temperature, increased turbidity, and agricultural/forestry practices over the last 50 years (LDEQ, 2006). This sediment impairment in the river has caused higher river stages downstream. The soil erosion rate for the Upper Amite River Basin has been calculated to be 5.42 ton/acre/year, producing a sediment load of 0.103 kg/m^3 to the Amite River (Mishra, 2005). There is a decreased redistribution of sediment into some of the swamps due to the dredged material berms of the ARDC.

Existing Conditions. The Blind River, which bounds the LCA ARDC study area to the southeast is the receiving water for the ARDC flow before discharging to Lake Maurepas, is listed on the 2006 303(d) list of impaired waterbodies as being impaired by excess sediments from the source to the outfall at Lake Maurepas (LDEQ, 2006). Sediment Total Maximum Daily Loads (TMDL), as well as a nutrient TMDL, is also required by the U.S. Environmental Protection Agency (USEPA) to be developed by 2011 for the Blind River.

To date, a limited amount of sediment samples within the ARDC and other waterbodies in the LCA ARDC study area (proximal upstream waterbodies) have been collected for analysis. The USGS is currently collecting data on both suspended sediments and bed sediments at five sites along the Amite River; however, this data will not be available until late 2010 (Dennis Demcheck, USGS, personal communication, April 10, 2009).

The USGS conducted a study in 1998 to examine the occurrence and distribution of trace elements and organic compounds in southern LA fishes and streambeds, including fine-grained samples and deep core sediment samples (bulk samples) (Skrobialowski, 2002). One of the sites at which sediment sampling was conducted for this study is located on the Amite River near Port Vincent, approximately 5.5 miles upstream of the ARDC.

While limited sediment sampling data is available at this time, LDEQ has an ongoing program (**http://www.deq.louisiana.gov/portal/default.aspx?tabid=2204**) to resample sediments of all waterbodies currently identified as impaired due to the presence of metals, using improved sampling methods to minimize sample contamination. In

the most recent (2006) 303(d) list (**http://www.epa.gov/region6/water/npdes/tmdl/303d/la/epa-final-list_2006.pdf**) of impaired waterbodies, all reaches of the Amite River, the Blind River, and the ARDC are listed as impaired for the Fish and Wildlife Propagation designated use because of mercury. While this was originally determined by LDEQ using fish tissue sampling, LDEQ would likely conduct sediment sampling for confirmation of this data prior to the 2011 TMDL deadline.

4.2.2.3 Water Use and Supply

Historic Conditions. Water use within the LCA ARDC study area is primarily limited to public drinking water. The Louisiana Department of Transportation and Development (LA DOTD) online registry of water wells (**http://www.dotd.louisiana.gov/intermodal/wells/**) identifies nine registered water wells owned by Diversion Water Company, L.L.C. (DWC) in the vicinity of the ARDC within the LCA ARDC study area. The LA DOTD water well registry also identifies 33 privately owned water wells in the LCA ARDC study area (primarily in the vicinity of LA-16 and LA-22). Water provided to the LCA ARDC study area by French Settlement Water Company, Inc. (FSWC) is obtained from a well north of the LCA ARDC study area in Head of Island along LA-22. Department of Agriculture (DOA) Section 10/404 Permits for existing waterfront developments on the left descending bank of the ARDC identify the locations of two pump stations associated with water wells at approximately 1.0 and 3.3 miles east of the Petite Amite River. Proposed new development projects on the south ARDC bank east of the Petite Amite River would receive water service from DWC. No surface drinking water system intake locations were identified in the vicinity of the LCA ARDC study area. Further water use and supply information is provided in Appendix L.

Existing Conditions. Water supply in the LCA ARDC study area is primarily obtained from the local Gonzales-New Orleans aquifer (LDEQ, 2007). However, a small number of wells in the LCA ARDC study area have local aquifer sources (identified in the LA DOTD well registry) of the 600 foot sand of Baton Rouge aquifer, the shallow sand (less than 400 foot) of Baton Rouge aquifer, and the Norco (Geismar) aquifer. All of these local aquifers are part of the Chicot Equivalent aquifer system. Conversion of swamp to open water reduces the water purification function of forested wetlands.

4.2.2.4 Groundwater

Historic Conditions. Sources of fresh groundwater in the LCA ARDC study area and vicinity include the Chicot Equivalent Aquifer, the Evangeline Equivalent Aquifer, and the Jasper Equivalent Aquifer. Rivers and streams within the LCA ARDC study area exhibit a meandering regime rather than the entrenched or braided regimes observed in areas with higher gradients.

Common geomorphologic features in this regime include crevasse splays, point bars, floodplains, abandoned channels, abandoned courses, and backswamps/flood basins. Backswamp/flood basin features are predominant in the vicinity of the LCA ARDC study area. Further groundwater information is provided in Appendix L (Engineering Appendix). Generally, groundwater has not been a major concern in the LCA ARDC study area.

Existing Conditions. Groundwater is not a major issue of concern in the LCA ARDC study area. The LA DOTD online registry of water wells identifies five registered water wells within the LCA ARDC study area and four registered wells within the one-mile buffer of the LCA ARDC study area boundary. Four of the wells within the LCA ARDC study area are in the Chinquapin community; these four wells range in depth from 300 to 445 ft below ground surface (bgs). Two of the wells are owned by the FSWC and two are owned by private citizens. The fifth well within the LCA ARDC study area is a 500-foot bgs well owned by DWC; it is located on the left descending bank of the ARDC. A 440-foot bgs well is located within the one-mile buffer on the left-descending bank of the Chinquapin Canal. A 495-foot well owned by DWC, is located within the one-mile buffer on the right descending bank of the ARDC. Two wells are located on the right descending back of the Blind River near its confluence with the ARDC: one 719-foot well registered to LA Public Works, and one 240-foot well registered to Gulf Engineers.

4.2.3 Water Quality and Salinity

This resource is institutionally significant because of the NEPA; the CWA; the Coastal Zone Management Act; and the Estuary Protection Act. This resource is technically significant because water supports most physical, chemical, geological, and biological processes throughout the entire estuarine system. This resource is publicly significant because the public demands clean water and healthy wildlife and fishery species for recreational and commercial use. Further water quality information is provided in Appendix L (Engineering Appendix).

The Clean Water Act of 1977 established a process for states to develop information on the quality of their water resources. Section 305(b) requires that each state develop a program to monitor the quality of its surface and groundwater and prepare a report describing the status of its water quality. Section 303(d) requires states to list impaired waterbodies where water quality standards are not met and designated uses are not fully supported, and to develop a TMDL for those waterbodies. Louisiana waterbody subsegments, their designated uses, and numerical water quality standards are identified in Louisiana Administrative Code Title 33, Part IX, Subpart 1, Chapter 11, Section 1123 (LAC 33:IX.1123). The LDEQ Water Quality Inventory Integrated Report is the current form of biennial reporting of the status of LA waters. The 2008 Final Draft Water Quality Inventory

Integrated Report summarizes the monitoring data that characterizes the quality of waters in the vicinity of the ARDC. The Final Draft has not yet been promulgated.

Section 303(d) of the Clean Water Act requires states to identify and list waterbody segments where water quality standards are not met and designated uses are not fully supported. The determination of the use support is based on specific guidance provided by the USEPA. A waterbody may fall within one of three use support categories depending on the percent of measurements for any one physical or chemical parameter that exceeds the state's numerical water quality standards. These categories include fully supporting, partially supporting, and not supporting. In the case where more than one parameter defines a designated use, support for each designated use is defined by the poorest performing parameter.

A draft Total Maximum Daily Load (TMDL) has been submitted by the Louisiana Department of Environmental Quality (LDEQ) and proposes a 60 percent reduction in non-point source (NPS) load within the ARDC in order to achieve current water quality standards. However, the LDEQ is in the process of conducting an ecoregional use attainability analysis that they suspect will modify the water quality standard such that the required NPS load reduction will be reduced to 25 percent.

4.2.3.1 Water Quality

Historic Conditions. Historic and current water quality issues for rivers and streams in coastal Louisiana include the transport of nutrients, pesticides, synthetic organic compounds, trace elements, suspended sediment, and bacteria. The LA Department of Health and Hospitals coordinates with the LDEQ, the Louisiana Department of Wildlife and Fisheries (LDWF), and the LA Department of Agriculture and Forestry to issue waterbody advisories aimed at protecting the public's health.

Human developments along the ARDC, Amite and Blind Rivers have begun to affect water quality. The ARDC northeast of Sorrento is listed as impaired for mercury (**http://www.epa.gov/region6/water/npdes/tmdl/303d/la/epa-final-list_2006.pdf**). The LCA ARDC study area falls within two LDEQ-defined waterbody subsegments. LDEQ waterbody subsegment 040402 is comprised of 10 square miles identified as the ARDC. The designated uses as assigned in LAC 33:IX.1123 for this subsegment are primary contact recreation (PCR), secondary contact recreation (SCR), and fish and wildlife propagation (FWP). LDEQ's 2004 Integrated Report listed subsegment 040402 as being fully supported for the PCR and SCR uses. The FWP use was identified as not supported because of nutrients and dissolved oxygen (DO) (**http://www.epa.gov/region6/water/npdes/tmdl/303d/la/epa-final-list_2006.pdf**). Suspected sources were unknown. LDEQ's 2006 Integrated Report

listed subsegment 040402 as being fully supported for the PCR and SCR uses. The FWP use was identified as not supported (**http://www.epa.gov/region6/water/npdes/tmdl/303d/la/epa-final-list_2006.pdf**) because of chlorides and mercury. Suspected sources included atmospheric deposition for mercury, and site clearance (i.e., land development or redevelopment) and drought-related impacts for chloride. Data collected in 2001 were used for both the 2004 and 2006 assessments.

Existing Conditions. Human developments result in wastewater and polluted runoff from nearby urban areas. The continued conversion of swamp habitat to marsh and open water reduces natural filtration of water. LDEQ's 2008 Final Draft Integrated Report lists subsegment 040402 as being fully supported for the PCR and SCR uses. The FWP use is identified as not supported because of chlorides, total dissolved solids (TDS), and mercury. Suspected sources include atmospheric deposition for mercury, site clearance (i.e., land development or redevelopment) and drought-related impacts for chloride. The TMDL for the segment are scheduled to be completed by 2011 (**http://www.deq.state.la.us/portal/tabid/130/Default.aspx**).

The LDEQ 2008 Final Draft Integrated Report lists subsegment 040403 as being fully supported for the PCR, SCR, and Outstanding Natural Water Resource (ONWR) uses. Data collected from 2006 were used for the 2008 assessment.

4.2.3.2 Salinity Regimes

Historic Conditions. Recent studies have reported that mean monthly salinities in the Lake Maurepas Basin have increased 2-3 parts per thousand (ppt) in comparison to data collected between 1955 and 1981 (USACE, 2004). The ARDC and the Blind River are two of the three main sources of freshwater input into Lake Maurepas. Salinity data from these two rivers has only been collected on a regular basis since the year 2000; therefore, it is difficult to determine whether the river systems have been impacted by the saltwater influence observed in the lake.

The construction of the ARDC resulted in the impounding of higher saline waters, thus increasing soil salinities. The dredged material berms of the ARDC prevent the flushing of these saline waters by the normal headwater event that follows tropical storms. This lack of flushing and impoundment of saline water leads to the continued degradation of the swamp habitat.

Existing Conditions. Elevated salinities caused by impoundment of storm-driven higher-salinity waters and the subsequent absorption of salt into the

substrate likely contribute to the degradation of the forested swamp and its eventual conversion to marsh and ultimately open water (Shaffer *et al*., 2006). Salinity data were collected at LDEQ stations 0268 on the ARDC and 0243 on the Blind River in 2006. Data at station 0243 were collected every month except August, September, and October. One salinity data point was collected in December 2001. Data were collected from 0268 in January, March, June, and November of 2006. LDEQ salinity data are summarized in Table 4.1.

Table 4.1. LDEQ Salinity in ppt

Date sampled	Salinity by LDEQ Station	
	0268 (ARDC)	0243 (Blind River)
12-11-01	---	0.1
1-10-06	0.1	0.1
2-7-06	---	0.1
3-7-06	0.2	---
3-21-06	---	1.1
4-18-06	---	0.2
5-2-06	---	0.1
6-13-06	0.3	1.9
7-31-06	---	0.1
11-16-06	0.1	---
12-19-06	---	0.1

Source: LDEQ, 2009.

Although the data are extremely limited, the salinity at the Blind River station (0243) was higher than at the ARDC station (0268) when sampled on the same day in June 2006 (LDEQ 2009). The mean salinity at Station 0268 in 2006 was 0.175 ppt; the mean salinity at Station 0243 in 2006 was 0.462 ppt, indicating that in 2006 the Blind River station was slightly more influenced by salt water than the ARDC station. Day *et al.* (2004) determined mean salinity in the Blind River study to be 0.144 ppt in the interval 2002-2003.

Salinity data from the Coastwide Reference Monitoring System (CRMS) stations are summarized in Table 4.2. The mean salinity of the Blind River stations is similar to that calculated from 2006 LDEQ data. Salinities at the Blind River surface water stations are nearly identical when plotted by monthly means (Figure 4.6). Although the mean concentration of the marsh well's salinity is

similar to that in the Blind River, the range of data is much narrower than that recorded for the Blind River, and the monthly averages trend differently.

Table 4.2 CRMS Salinity Data Summary in ppt (http://dnr.louisiana.gov/crm/coastres/monitoring.asp)

Station	Salinity		
	Mean	Low	High
CRMS0061-H01	0.34	0	2.38
CRMS0038-H01	0.44	0	2.15
CRMS5845-H01	0.42	0	2.77
CRMS0008-W01	0.48	0.13	0.86

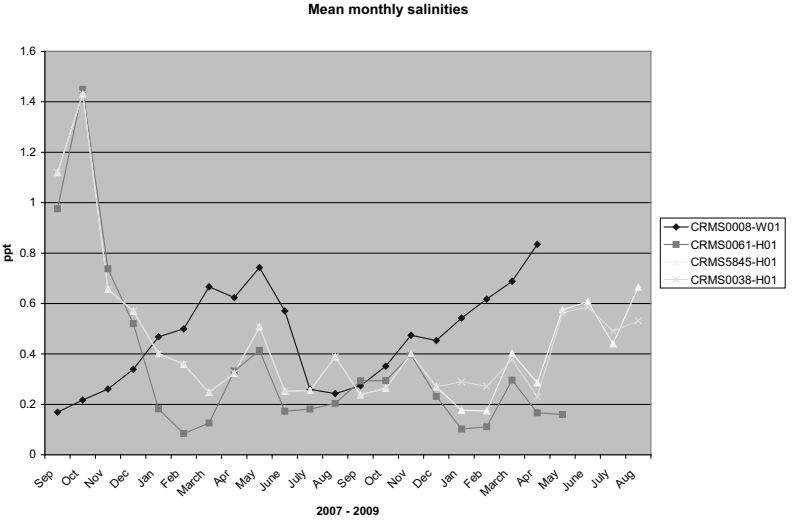


Figure 4.6. Mean Monthly Salinities from Four CRMS Stations in the Area (http://dnr.louisiana.gov/crm/coastres/monitoring.asp).

4.2.4 Air Quality

This resource is institutionally significant because of the Clean Air Act of 1963, as amended, and the LA Environmental Quality Act of 1983, as amended. Air quality is technically significant because of the status of regional ambient air quality in relation to the National Ambient Air Quality Standards (NAAQS). Air quality is publicly significant because of the desire for clean air and public health concerns expressed by many citizens.

The Clean Air Act Amendment of 1990 directed the USEPA to establish NAAQS for all regulated air pollutants. Federal air quality standards have been established for the following six pollutants that are considered as criteria air pollutants:

- Carbon monoxide (CO),
- Nitrogen dioxide (NO_2),
- Ozone (O_3),
- Sulfur oxides (commonly measured as sulfur dioxide [SO_2]),
- Lead (Pb),
- Particulate matter no greater than 2.5 micrometers (µm) in diameter ($PM_{2.5}$), and
- Particulate matter no greater than 10 µm in diameter (PM_{10}).

These pollutants are known as criteria air pollutants.

Historic Conditions. The LCA ARDC study area was in nonattainment for the interval 2004-2007 for ozone (8-hour average) (**http://www.epa.gov/oar/data**), EPA 2009). The measurements include both criteria air pollutants and hazardous air pollutants and are compared against the NAAQS specified by the USEPA. Each row of the table lists standards-related air pollution values for available criteria pollutants for one year. The values shown are the highest reported during the year by all monitoring sites in each parish. Air quality is not a major issue for the LCA ARDC study area.

Existing Conditions. Air quality in the LCA ARDC study area is generally good to moderate, with minimal periods in which air quality is classified as unhealthy for the general public or for sensitive groups (http://www.epa.gov/oar/data, EPA, 2009). Of the six criteria air pollutants, O_3 and $PM_{2.5}$ are most likely to occur within the Baton Rouge Metropolitan Statistical Area (MSA). However, the air quality did not exceed NAAQS limits for these parameters in the LCA ARDC study area for 2008 (**http://www.epa.gov/oar/data**). The area is in a non-attainment area for ozone.

4.2.5 Noise

Noise is institutionally significant because of the Noise Control Act of 1972 that declares the policy of the United States is to promote an environment for all Americans free from noise that jeopardizes their health or welfare; and the Occupational Safety and Health Standards (29 CFR, part 1910) regarding protection against the effects of noise exposure. Noise is technically significant because noise can negatively affect the physiological or psychological well-being of an individual ranging from annoyance to adverse physiological responses, including permanent or temporary loss of hearing; and other types of disturbance to humans and animals, including disruption of colonial nesting birds (Kryter, 1994). Noise is publicly significant because of the public's concern for the potential annoyance and adverse effects of noise on wildlife and humans.

Occupational noise exposure is regulated by 29 CFR Part 1910, subpart G. The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) is the enforcing agency. OSHA has established noise exposure standards in order to protect the hearing of employees. Noise exposure for the construction industry is regulated by 29 CFR, Part 1926.52, and Occupational Noise Exposure.

Historic Conditions. Until development in the 1950s, noise pollution was of no concern. More recent historical sources of noise have been developments (1980s) and recreational boat traffic within the LCA ARDC study area.

Existing Conditions. Noise is typically associated with human activities and habitations, such as the operation of commercial and recreational boats, ships, air boats, and other recreational vehicles; operation of machinery and motors; and human residential-related noise (air conditioners, lawn mowers, etc.). However, the LCA ARDC study area is remote and uninhabited marsh. The noise from distant urban areas has little if any impacts on the area. As the population in the LCA ARDC study area continues to grow and develop, some noise pollution would occur. The ambient noise caused by boat traffic and human activity in the ARDC, Amite and Blind rivers may cause some minimal and temporary disturbances in the area.

4.2.6 Vegetation Resources

Coastal vegetation resources are institutionally significant because of the Coastal Barrier Resources Act of 1982; Coastal Zone Management Act (CZM) of 1972; Emergency Wetlands Resources Act of 1986; Estuary Protection Act of 1968; Fish and Wildlife Conservation Act of 1980; the Fish and Wildlife Coordination Act of 1958, as amended; Migratory Bird Conservation Act; Migratory Bird Treaty Act; Endangered Species Act of 1973 (ESA); the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (Magnuson-Stevens Act); the Magnuson-Stevens Reauthorization Act of 2006; NEPA; the North American

Wetlands Conservation Act; the Water Resources Development Acts of 1976, 1986, 1990, and 1992; and EO 13186 Migratory Bird Habitat Protection. Coastal vegetation resources are technically significant because they are a critical element of the coastal habitats. Additionally, coastal vegetation resources serve as the basis of productivity, contribute to ecosystem diversity, provide various habitat types for fish and wildlife, and are an indicator of the health of coastal habitats. Coastal vegetation resources are publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value.
The LCA ARDC study area includes swamps, rivers, creeks, and bayous. Gulf Coast estuaries are among the most productive natural systems, producing more food per acre than the most productive Midwestern farmland and are second only to Alaska for domestic landings of commercial fish and shellfish (National Coastal Condition Report II) (**http://www.epa.gov/owow/oceans/nccr/2005/index.html**).

Habitat and historic land cover analysis for the LCA ARDC study area was performed by the USGS (USGS 2009 Map ID; USGS-National Wetlands Research Center [NWRC] 2010-11-007). The most recent land cover data identified by the habitat analysis was the 2000 Louisiana Coastal Area Habitat dataset. This dataset depicts information on the geographic distribution of land use/land cover for Louisiana. This dataset consists of digital data describing the land use/land cover (mainly vegetation, but including water and urban environments) for the State of Louisiana. Information is presented in the form of digital maps compiled using 1999 LandSat 7 Thematic Mapper classified land/water data, 1993 land cover classification for the Louisiana Gap Analysis Program, and 2001 Louisiana Coastal Marsh Vegetative Type map data. Attribute fields describe the different land cover types occurring within the polygon or associated with each pixel.

Approximately 27,984 acres are within the LCA ARDC study area. The geographic distribution of these land cover classifications is shown in Figure 4.7. The various land cover classifications, by acre, in the LCA ARDC study area, from the Louisiana Coastal Area Habitat dataset are presented in Table 4.3. The vegetation classification descriptions and acreage within the LCA ARDC study area are described in the following sections.

Approximately 25,634 acres (91.6 percent) of the LCA ARDC study area is comprised of wetland communities including forested and non-forested (scrub-shrub wetlands and fresh marsh - Table 4.3). Forested upland communities comprise approximately 441 acres (1.6 percent) of the LCA ARDC study area and consist primarily of pine thickets or upland forest communities. Approximately 1,142 acres (4.1 percent) of the LCA ARDC study area consist of open water, including rivers, streams, and canals. Open water areas within the LCA ARDC study area include the ARDC; the Amite, Petite Amite, and Blind Rivers; Bayous Pierre and Chene Blanc; and the Chinquapin Canal; and are distributed throughout the LCA ARDC study area. Developed land, which consists primarily of fringing suburbs and built-

up areas of metropolitan communities containing sufficient coverage of woody and non-woody vegetation to include urban features, comprises approximately 281 acres (1.0 percent) of land within the LCA ARDC study area. Vegetated urban areas are primarily confined to the dredged material berms lining the ARDC residential areas adjacent to LA-22, and the right descending bank of the Amite River in the northwestern portion of the LCA ARDC study area. Barren land makes up a small percentage of the LCA ARDC study area and may include rangelands, strip mines, quarries, and gravel pits. Agricultural cropland or grassland makes up approximately 469 acres (1.6 percent) of the LCA ARDC study area and appears to be restricted to livestock pasture. These pastures are located in isolated pockets along the lower Amite River and LA-22 in the western LCA ARDC study area.

Table 4.3. Land Cover in the LCA ARDC Study Area by Acre (2000 Louisiana Coastal Area Habitat Analysis)

Land Cover Classification	Acres	Percent of LCA ARDC study area
Wetlands		
Wetland Forest	25,316	90.4%
Non-Forested Wetland		
Fresh marsh	226	0.8%
Wetland scrub/shrub	91	0.3%
Swamp	0	0.0%
Subtotal Wetlands	**25,633**	**91.6%**
Uplands		
Upland forest	441	1.6%
Upland scrub/shrub	0	0.0%
Subtotal Uplands	**441**	**1.6%**
Water: Streams and Canals	**1,142**	**4.1%**
Developed Land	**281**	**1.0%**
Barren Land	**18**	**0.1%**
Agriculture/Pasture	**469**	**1.6%**
TOTAL	**27,984**	**100%**

Note: The 2000 Louisiana Coastal Area habitat data composition is a hybrid dataset of the following:

- 1993 Land Cover Classification for the Louisiana Gap Analysis Project;
- November 18, 1999 Landsat 7 TM Classified Land/Water Data; and
- 2001 Louisiana Coastal Marsh Vegetation Type Map.

4.2.6.1 Riparian Vegetation

Historic Conditions. Construction of the ARDC in 1956 created riparian habitat along the sidecast dredged material berms; riparian habitat is also present on some of the banks of other waterbodies (Figure 4.7). Riparian zones within the LCA ARDC study area were historically confined to the natural banks of the Petite Amite and Blind Rivers as well as a myriad of smaller natural tributaries within the interior of the marsh.

Existing Conditions. Depending on the elevation, these corridors are forested with a myriad of tree species; the wettest areas are dominated by bald cypress/tupelo while the highest elevation areas are dominated by hardwood tree species such as oak, ash and elm. Riparian habitat along the ARDC is well defined; a steep geological gradient limits the influence of the ARDC and the spread of hydrophytes. This area as well, has remained relatively stable since the ARDC was completed.

4.2.6.2 Wetland Vegetation

Wetlands are defined as areas that are covered by water or that contain saturated soils for a minimum of five percent of the growing season, or approximately 14 days (33 CFR 328.3(b); 40 CFR 230.3(t)). Wetlands provide protection from wave action, erosion, and storm damage and provide various consumptive and non-consumptive recreational opportunities.

Historic Conditions. Prior to the early 20th century, the LCA ARDC study area was an unbroken expanse of wetlands interspersed with meandering bayous such as the Petite Amite and Amite Rivers. The LCA ARDC study area contains approximately 27,984 acres of primarily bald cypress-tupelo swamp habitat. The LCA ARDC study area is located within the Amite/Blind mapping unit (LCWCRTF, 1999). This mapping unit contains 190,036 acres in portions of St. James, Ascension, Livingston, and St. John the Baptist Parishes. Between 1932 and 1956, about 1,600 acres of wetlands were lost in the Amite/Blind mapping unit mainly to shoreline erosion and direct removal (LCWCRTF, 1999). Although there were no significant shifts in habitat type within this mapping unit from 1956 to 1990, the swamp vegetation is becoming increasingly stressed.

Existing Conditions. Wetland coverage data within the LCA ARDC study area were obtained from the National Wetlands Inventory (NWI) (www.fws.gov/wetlands). The NWI is maintained by the U.S. Fish and Wildlife Service (USFWS) and provides general wetland occurrence data for coastal regions in the United States. NWI data does not constitute geospatially precise wetland delineations, but rather provide basic occurrence data regarding the classification and approximate areal extent of wetland coverage within a given area. NWI

wetland types are described according to the regimes devised in the USFWS Publication *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin *et al*., 1979).

Wetland habitat types within the LCA ARDC study area are characterized into four major categories: palustrine forested (92.77 percent); palustrine emergent, scrub-shrub, unconsolidated bottom, and aquatic bed (1.2 percent); uplands (4.4 percent), and riverine (lacustrine). Figure 4.8 presents a map of the wetland types in the LCA ARDC study area.

The most common wetland regime in the LCA ARDC study area is wetland forest (Figure 4.7). About 18,204 acres of primarily bald cypress-tupelo swamp habitat are presently impounded at different levels within the LCA ARDC study area. Existing swamp habitats are converting to marsh and shallow open water habitats. Saltwater intrusion from storm events has additionally stressed the swamp habitat along the Blind River. The other dominant habitat types include water (1,123 acres), upland forest (406 acres), agriculture/pasture (375 acres), developed (251 acres), and fresh marsh (249 acres) (Figure 4.7).

Functions lost include habitat for wildlife and aquatic species, recreational opportunities, aesthetics, and storm surge protection. Upon severe degradation; the swamp will convert to freshwater marsh, then to open water. The freshwater marsh does offer some of the functions of the freshwater swamp, but certain functions are lost, such as habitat for avian species and storm surge protection. It is a national priority to preserve and protect freshwater swamps.

Vegetation Communities. Common plant species in the LCA ARDC study area are presented in Table 4.4 by habitat type. Many species occur in more than one habitat. Highly flood-tolerant bald cypress (*Taxodium distichum*) and water tupelo or tulepo-gum (*Nyssa aquatica*) dominate the overstory of much of the Maurepas Swamp, including the LCA ARDC study area (Conner and Day, 1976). This dominance is due in part to their ability to produce secondary roots with the capacity to oxidize the area surrounding their roots in flooded, anaerobic soils.

In addition to bald cypress and water tupelo, swamp red maple (*Acer rubrum* var. *drummondii*), green ash (*Fraxinus pennsylvanica*), swamp tupelo (*Nyssa sylvatica* var. *biflora*), and various oak species (*Quercus* spp.) are also found in bald cypress-tupelo swamp habitat within the LCA ARDC study area, with swamp red maple and green ash comprising sub-dominant midstory species (Conner and Day, 1976; Hoeppner, 2008; Shaffer *et al.*, 2003). Scrub species, including black willow (*Salix nigra*), wax myrtle (*Morella cerifera*), and buttonbush (*Cephalanthus occidentalis*) are sporadically present, particularly in areas with diminished canopy cover caused by impaired health or mortality of overstory species.

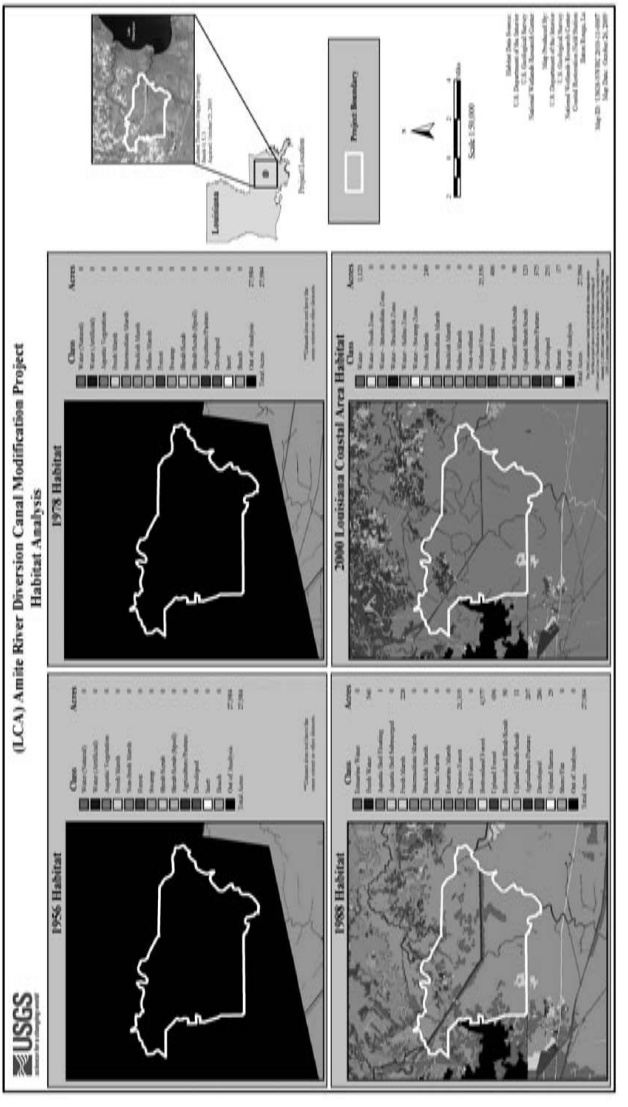
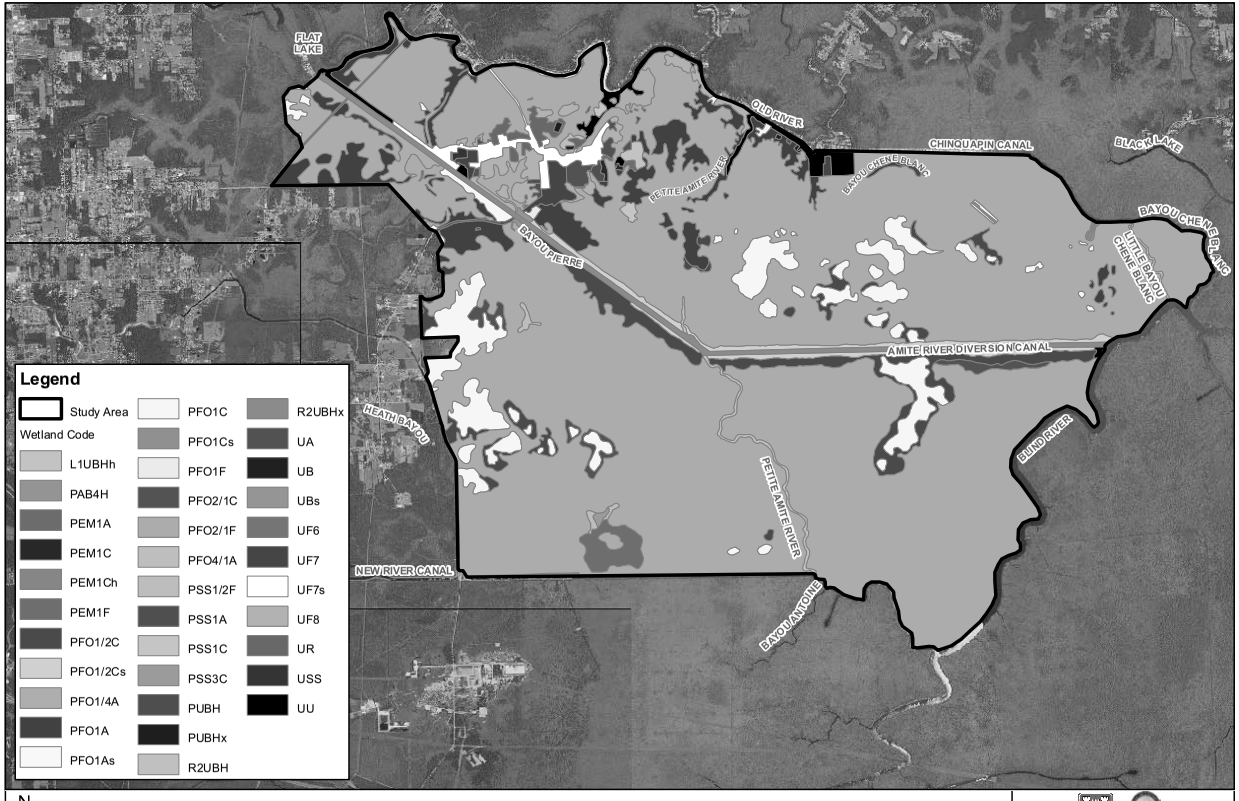


Figure 4.7. Land Cover within the LCA ARDC Study Area (USGS, 2009)

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WETLAND TYPE MAP

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Wetland Data: National Wetlands Research Center Habitat Data for Gulf of Mexico Coast, Louisiana, 1988
Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 4.8
Date: November 2009
Scale: 1:90,000
Source: USDA/NWRC/GEC
Map ID: 27850108-1850

Table 4.4. Common Plant Species in the Study Area by Habitat Type (USDA, 2008)

Common Name	Scientific Name	Habitat Type(s)
Bald cypress	*Taxodium distichum*	Bald cypress-Tupelo
Black Willow	*Salix nigra*	Bald cypress-Tupelo
Green Ash	*Fraxinus pennsylvanica*	Bald cypress-Tupelo
Swamp Tupelo	*Nyssa biflora*	Bald cypress-Tupelo
Tupelo Gum	*Nyssa aquatica*	Bald cypress-Tupelo
Buttonbush	*Cephalanthus occidentalis*	Bald cypress-Tupelo Fresh Marsh
Bulltongue	*Sagittaria lancifolia*	Fresh Marsh Intermediate Marsh
Dwarf Spikerush	*Eleocharis parvula*	Fresh Marsh Intermediate Marsh
Wax Myrtle	*Myrica cerifera*	Fresh Marsh Intermediate Marsh
Alligator Weed	*Alternanthera philoxeroides*	Fresh Marsh
Arrow Arum	*Peltandra virginica*	Fresh Marsh
Lizard's Tail	*Saururus cernuus*	Fresh Marsh
Maidencane	*Panicum hemitomon*	Fresh Marsh
Swamp Smartweed	*Polygonum punctatum*	Fresh Marsh
Chinese Privet	*Ligustrum sinense*	Upland Ridge
Chinese Tallowtree	*Triadica sebifera*	Upland Ridge
Swamp Red Maple	*Acer rubrum var. drummondii*	Upland Ridge Bald cypress-Tupelo
Water Oak	*Quercus nigra*	Upland Ridge Bald cypress-Tupelo
Laurel Oak	*Quercus laurifolia*	Upland Ridge Bald cypress-Tupelo

Much of the bald cypress-tupelo swamp habitat within the LCA ARDC study area is not fully stocked, suggesting that environmental stressors are affecting regeneration and stand growth (Chambers *et al.*, 2005). Altered hydrological conditions in southeastern LA have reduced or eliminated natural regeneration of bald cypress and water tupelo, and reduced productivity. Neither bald cypress nor water tupelo seeds germinate in water, and submerged cypress seedlings die within three to six weeks (Demaree, 1932, Souther, 2000). Flooding caused by relative sea level rise (primarily as a result of regional subsidence) has decreased the probability of natural regeneration of many stands of bald cypress-tupelo forest (Conner *et al.*, 1981; Chambers *et al.*, 2005). The swamps in the LCA ARDC study area and vicinity are impacted by elevated levels of subsidence and consequent saltwater intrusion, and experience a lack of sediment and nutrient input. Tree recruitment is further severely limited by the mammalian seedling predator nutria (*Myocastor coypus*), and in many areas of the swamp, bald cypress

and water tupelo are defoliated annually by outbreaks of bald cypress leafrollers (*Archips goyerana*) and forest tent caterpillars (*Malacosoma disstria*) (Myers *et al.*, 1995; Beville, 2002; Effler, *et al.*, 2006).

Vegetative communities are affected by water level and RSLR. The RSLR that can be expected for the LCA ARDC Modification project area is from 5 to 9 mm/year (2 to 4 mm/year of subsidence and 3 to 5 mm/year of eustatic sea level rise) (Penland and Ramsey 1990). Guidance provided from EC-1165-2-211 gives a means by which to estimate the impacts of relative sea level rise. Specifically, within the LCA ARDC study area, sea level rise is predicted to occur from 1.5 ft (0.46 m) to 3.2 ft (0.97 m) over the 50-year period of analysis of the project.

Whether marsh substrate accretion can keep pace with sea level rise depends on processes involving sediment deposition on the marsh surface and below ground production of organic matter (DeLaune *et al*., 1983; Turner, 1990; Reed, 1995; Day *et al.*, 2000). These processes vary both spatially and temporally and are not well understood in many LA marsh systems (Jarvis C. Jessie, unpublished data). It is estimated that the net accretion rate would be 8mm/year within the healthiest portions of the LCA ARDC study area (Bernard Wood, unpublished data, 2005 through 2009). These net accretion rates account for subsidence, but not eustatic sea level rise. Based on these estimates, accretion rates could reduce the potential impacts of sea level rise within the healthiest portions of the LCA ARDC study area.

4.2.6.3 Upland Vegetation

Several ridge remnants run through the LCA ARDC study area. These ridges are mostly near the mid-point of the east-west stretch of the ARDC. The dominant tree structure includes bald cypress, black gum, swamp gum, Drummond's red maple, green ash, diamond oak, water oak, black willow, American elm, and tallow (Field Investigation, 2009). Wax myrtle, black berry, black willow, Chinese tallow tree, and Chinese privet typically dominate the shrub stratum. In addition, an old railroad grade and several earthen levees run through the LCA ARDC study area with similar habitats.

Historic Conditions. Historically, the upland vegetation composition has changed little from what can be found today. These uplands constituted old natural levees that subsided at a different rate than the surrounding marsh. Ultimately, as subsidence occurs over the course of thousands of years, these areas are converted into freshwater swamps and then marshes before becoming open water as they sink beneath mean water level. The vegetation of the ridges in the coastal region served as refuges for wildlife and native people during high water events and was important, both for food and forage.

Settlers began to move into the area around 1721 (Haydel, 1998), but no large scale alterations in the upland vegetation structure occurred until logging operations for cypress began in 1891 and continued until the early 1930s (Haydel, 1998). A fully functional railroad carried logs that fell in the swamp to the sawmill; the railroad was abandoned shortly after the mill closed. The great majority of the forests were logged, leaving small, deformed target trees, and some non-target species behind. The mature forest we see today is a regrowth.

The ARDC was completed in the 1964. The upland vegetation of the dredged material berms lining the ARDC and the old railroad grade differs little from the natural ridges in community composition.

Existing Conditions. Upland vegetation on the natural ridges is being impacted due to increasing water in impounded areas. This stresses existing trees and shifts the community toward a wetter cypress/tupelo forest. This disturbance also provides an opportunity for invasive species to gain a foothold and crowd out developing native vegetation. Upland vegetation on the dredged material berms (spoil) and the railroad grade is undergoing a much more dramatic change as threats from residential development impact the site.

4.2.6.4 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is an important source of food and habitat for both aquatic resources and wildlife. SAV provides structure and habitat for many invertebrates that provide food for larger aquatic resources, such as many stages of fishes. SAV also provides food for many avian species such as waterfowl. SAV also provides feeding habitat for fish-eating birds such as herons and egrets.

Historic Conditions. SAV is limited to shallow areas with flow that is high enough to keep the area clear of floating species within the ARDC and other waterbodies. Historically, SAV communities within the LCA ARDC study area have been dominated by native species such as fanwort (*Cabomba carolinana*), coontail (*Ceratophyllum demersum*), small pondweed (*Potamogeton pusillus*), bladderwort (*Utricularia vulgaris*), water nymph (*Najas guadalupensis*), widgeon grass (*Ruppia maritima*), and wild celery (*Vallisneria americana*).

Existing Conditions. SAV communities within the LCA ARDC study area are largely confined to areas of higher flow within the LCA ARDC study area. This includes natural waterways and natural cuts into the swamp interior. Shallow water habitats within the LCA ARDC study area that have insufficient flow have become choked with floating vegetation, greatly limiting light penetration within the water column.

4.2.6.5 Invasive Species – Vegetation

The EO 13112 was signed on February 3, 1999 establishing the National Invasive Species Council to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological and human health impacts that invasive species cause.

In coastal LA, water hyacinth (*Eichhornia crassipes*), alligatorweed (*Alternanthera philoxeroides*), hydrilla (*Hydrilla verticillata*), and Chinese tallow (*Triadica sebifera*) are well-known invasive plants. More recently, common salvinia (*Salvinia minima*), giant salvinia (*Salvinia molesta*), and variable-leaf milfoil (*Myriophyllum heterophyllum)* also have become invasive, displacing native aquatic species and degrading water quality and habitat quality (LACPR, 2009). Invasive plant species within the LCA ARDC study area include water hyacinth, alligatorweed, hydrilla, common salvinia, giant salvinia, Chinese tallow, and Chinese privet (*Ligustrum sinense*) (LCA, 2004).

Historic Conditions. Natural processes form coastal vegetation resources. Invasive species have been intentionally and unintentionally released and are outcompeting native vegetation species and spreading throughout many habitat types. Historically (pre-European), the LCA ARDC study area consisted of several palustrine habitats including submerged aquatic beds, fringe freshwater marsh, and cypress/tupelo swamp. These systems were not impacted by any invasive species.

Existing Conditions. Each of these invasive species is well established within the LCA ARDC study area. The impacts of each of these species on the native flora include physical competition for resources such as nutrients and light, impacts to community structure and composition, and impact to ecosystem processes and system wide parameters. Water hyacinth, common salvinia, giant salvinia, and hydrilla all limit the amount of light penetrating the water column which in turn impacts plankton biomass production. Alligatorweed, Chinese tallow and Chinese privet are of minimal wildlife value and can proliferate until nearly monocultural stands exist, limiting food available for wildlife.

4.2.6.6 Rare, Unique, and Imperiled Vegetative Communities

The unique communities, nestled within the broader vegetative habitats, are important in that they contribute to the extensive diversity of the coastal ecosystem, are the basis for its productivity, and are essential to the stability of the bionetwork. Overall, plant communities provide protection against substrate erosion and contribute food and physical structure for cover, nesting, and nursery habitat for wildlife and fisheries. Continued degradation and loss of existing

wetland areas would accelerate decline in the interdependent processes of plant production and vertical accretion necessary for a stable ecosystem.

The Louisiana Natural Heritage Program (LNHP), administered by the Louisiana Department of Wildlife and Fisheries (LDWF), maintains a directory of over 6,000 occurrences of rare, threatened, or endangered species; unique natural communities; and other distinctive elements of natural diversity; and has identified approximately 380 ecologically significant sites statewide (**http://www.wlf.louisiana.gov/experience/naturalheritage/**). The LNHP was queried for site-specific rare, unique, or imperiled vegetative community occurrence data in the LCA ARDC study area. According to this database, the only communities present in the LCA ARDC study area are cypress-tupelo swamp and fresh marsh.

4.2.7 Wildlife and Habitat

This resource is institutionally significant because of NEPA; the Coastal Zone Management Act; Estuary Protection Act; the Fish and Wildlife Coordination Act of 1958, as amended; the Migratory Bird Conservation Act of 1929, as amended; the Migratory Bird Treaty Act of 1918; the ESA of 1973, as amended; the Fish and Wildlife Conservation Act of 1980; the North American Wetlands Conservation Act; EO 13186 Migratory Bird Habitat Protection; Migratory Bird Conservation Act; and the Marine Mammal Protection Act (MMPA). Wildlife resources are technically significant because they are a critical element of the coastal barrier ecosystem, they are an important indicator of the health of coastal habitats, and many wildlife species are important recreational and commercial resources. Wildlife resources are publicly significant because the public places a high priority on their aesthetic, recreational, and commercial value.

The USFWS, in letters dated October 15, 2008 and January 20, 2009, formally requested that significant fish and wildlife resources within the LCA ARDC study area be fully considered and addressed in this study (Appendix B). The USFWS identified two threatened and endangered species, Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) and West Indian manatee (*Trichechus manatus*), and one delisted species, bald eagle (*Haliaeetus leucocephalus*) that are known to occur within the LCA ARDC study area. Further information on Gulf Sturgeon and the West Indian Manatee is available in Section 4.7.11 of the report. Additionally, the USFWS indicated that the LCA ARDC study area is known to support colonial nesting waterbirds (e.g., herons, egrets, ibis, night-herons, and roseate spoonbills). As a result of the public review process, the USFWS recommended minimizing disturbance to colonies containing nesting wading birds, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, the USFWS recommended that on-site

contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

Historic Conditions. The Amite/Blind River mapping unit contains part of one of the largest remaining tracts of forested wetlands in the Lower Mississippi River Valley and is extremely important to Neotropical migratory songbirds, waterfowl and many other species of wildlife (LCWCRTF and WCRA, 1999). Stopover habitat, where migratory birds can rest and refuel, is critical to successful migrations, particularly across the Gulf of Mexico (Stouffer and Zoller, 2006). Louisiana coastal wetlands provide Neotropical migrants essential stopover habitat on their annual migration route. The greatest threat facing Neotropical migrants is habitat loss (American Bird Conservancy, 2009). The coastal wetlands in the LCA ARDC study area provide important wildlife habitats, especially transitional habitat between estuarine and marine environments, used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. Table 4.5 shows the status, functions of interest, trends, and projections through 2050 for avifauna, furbearers, game mammals, and reptiles within the LCA ARDC study area and vicinity (LCWCRTF and WCRA, 1999). See Section 4.2.11 for information about threatened and endangered species.

The bald eagle was officially removed from the List of Endangered and Threatened Species on August 8, 2007. However, the species continues to be protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). The USFWS developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations regarding how to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. The guidelines recommend maintaining: (1) a specified distance between the activity and the nest (buffer area); (2) natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees. A copy of the NBEM Guidelines is available at:
www.fws.gov/migratorybirds/issues/BaldEagle.

Table 4.5. Status, Functions of Interest, Trends, and Projections through 2050 for Avifauna, Furbearers, Game Mammals, and Reptiles within the LCA ARDC Study Area (LCWCRTF and WCRA, 1999)

Mapping Unit	Type	% of unit	Furbearers												Game Mammals								Reptiles				Avifauna											
			Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbit				Deer				Alligator				Brown Pelican				Seabirds				Wading Birds			
			Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection
Amite/Blind (Includes LCA ARDC study area)	FS	73	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	D	D	Mu	Mo	I	D	Mu	Mo	I	I	---	---	---	---	---	---	---	---	Ne	Hi	I	I
	HF	21	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	D	D	Mu	Mo	I	S	Mu	Lo	Sy	Sy	---	---	---	---	---	---	---	---	---	---	---	---

Mapping Unit	Type	% of unit	Avifauna (cont'd)																																	
			Shorebirds				Dabbling Ducks				Diving Ducks				Raptors				Rails, Coots Gallinules				Other Woodland Residents				Other Woodland Migrants			
			Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection	Function	Status	Trend	Projection
Amite/Blind (Includes LCA ARDC study area)	FS	73	---	NH	---	---	Mu	Lo	Sy	Sy	---	NH	---	---	---	---	---	---	---	NH	---	---	Ne	Mo	I	Sy	Mu	Mo	Sy	Sy
	HF	21	---	NH	---	---	Mu	Lo	Sy	Sy	---	NH	---	---	---	---	---	---	---	NH	---	---	Ne	Hi	I	D	Mu	Mu	Sy	D

Type: FS = Fresh Swamp; HF = Hardwood Forest.
Function: Ne = Nesting; St = Stopover Habitat; W = Wintering; Mu = Multiple Use
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Trends (since 1985)/Projections (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Existing Conditions. Louisiana's coastal areas have many different wildlife species, including important game animals such as white-tailed deer (*Odocoileus virginianus)*, eastern cottontail (*Sylvilagus floridanus*), swamp rabbit *(Sylvilagus aquaticus)*, gray squirrel *(Sciurus canadensis)*, fox squirrel *(S. niger)*, and raccoon *(Procyon lotor)*; furbearers include muskrat *(Ondatra zibethicus)*, nutria (*Myocastor coypus)*, mink *(Mustela vison)*, Virginia opossum (*Didelphis virginiana*), striped skunk *(Mephitis mephitis)*, bobcat *(Lynx rufus)*, beaver *(Castor canadensis)*, and coyote *(Canis latrans)*; insectivores, bats, rodents, and the nine-banded armadillo *(Dasypus novemcinctus)* (Gosselink *et al.,* 1998.) The American alligator *(Alligator mississippiensis),* wild turkey *(Meleagris gallopavo),* river otter *(Lutra canadensis),* wading birds, dabbling ducks, and Neotropical songbirds are also found. Hunting for deer, feral hogs, wild turkey, rabbits, squirrels, and ducks occurs within and around the LCA ARDC study area.

Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow) near fresh to intermediate marshes or open water in the southeastern parishes. Areas with high numbers of nests include the Lake Verret Basin south to Houma, the marsh/ridge complex south of Houma to Bayou Vista, the north shore of Lake Pontchartrain, and Lake Salvador. Eagles also winter, and infrequently nest, in mature pine trees near large lakes in central and northern Louisiana. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead). Breeding bald eagles occupy "territories" that they would typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternative nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival. Bald eagles are commonly seen in the LCA ARDC study area. A bald eagle nest has been located within the LCA ARDC study area.

Invasive Wildlife Resources. Two invasive mammals, nutria and feral hogs (*Sus scrofa*), can be found in the LCA ARDC study area (LDWF, 2010; Keddy, *et al.,* 2007).

Nutria are large semi-aquatic rodents introduced from South America that live in fresh, intermediate and brackish marsh and feed on vegetation that is vital to sustaining Louisiana's coastline. High nutria population densities damage wetland vegetation and further wetland loss. Nutria consume both above and below ground parts of wetland plants (Keddy, *et al*., 2007). Nutria damage to areas, referred to as "eat outs," can be great. Nutria grazing can strip large patches of

marsh, and their digging overturns the marsh's upper peat layers (Keddy *et al.*, 2007). Aerial surveys estimated 80,000 acres of marsh were damaged by nutria; nutria damage in recent years is concentrated in the Deltaic Plain in southeastern Louisiana (Keddy et. al. 2007).

The feral hog is an exotic species which has expanded its range throughout most of Louisiana. Feral hogs cause extensive damage to natural wildlife habitat, privately-managed food plots for deer and turkey, and farm ponds and watering holes for livestock. In Louisiana, the frequency of feral hogs around agricultural areas has led to conflicts with sugarcane, rice, and corn farmers by the destruction of crops from excessive digging (Reed, 2007). Additionally, the wild omnivores compete with native wildlife for food resources; prey on young domestic animals and wildlife; and carry diseases that can affect pets, livestock, wildlife and people (Seward *et al.*, 2004).

4.2.8 Aquatic Resources

Planktonic organisms are institutionally significant because of NEPA, the Coastal Zone Management Act, and the Estuary Protection Act. This resource is technically significant because plankton may provide a major, direct food source for animals in the water column and in the sediments; plankton are responsible for at least 40 percent of the photosynthesis occurring on the earth; plankton are important for their role in nutrient cycling; plankton productivity is a major source of primary food-energy for most estuarine systems; and phytoplankton production is the major source of autochthonous organic matter in most estuarine ecosystems (Day *et al.*, 1989). This resource is publicly significant because in freshwater lakes and larger rivers, plankton form the lowest trophic food level for many larger organisms important to commercial and recreational fishing (Hynes, 1970).

Benthic organisms are institutionally significant because of NEPA; the Coastal Zone Management Act; and the Estuary Protection Act. Benthic species are technically significant because they are directly or indirectly involved in most physical and chemical processes and trophic relationships that occur in aquatic ecosystems. This resource is publicly significant because benthic organisms are food for many larger organisms important to commercial and recreational fishing.

4.2.8.1 Plankton

Historic Conditions. Construction of the ARDC resulted in dredged material berms which limits exchange of organisms and water between the swamp and the ARDC. Phytoplankton (microscopic plants) are the primary producers of the water column and form the base of the plankton community. Freshwater zooplankton are dominated by four major groups of animals: protozoa, rotifers, cladocerans, and copepods. Zooplankton provide the trophic link between the

phytoplankton and the intermediate level consumers such as aquatic invertebrates, larval fish, and smaller forage fish species (Day, *et al.*, 1989). Zooplankton populations in Louisiana ponds, swamps, ditches, and streams were found to be primarily protozoa by Bamforth (1962). Rotifer populations peak once or twice a year in coastal Louisiana freshwater systems, and during this peak may constitute almost the entire zooplankton community (Gosselink *et al.*, 1998).

Phytoplankton blooms can create anoxic conditions and can cause widespread mortality of fish populations (Day *et al.,* 2001). Phytoplankton production in coastal wetland systems is most likely to be nitrogen limited (Day *et al.,* 2001). Swamps such as those present within the LCA ARDC study area have been shown at times to be both sources and sinks of nutrients, particularly nitrogen. Although phosphorus is typically the limiting nutrient which is attributed to excessive algal growth (blooms), Lane *et al. (*2003) found that the Maurepas swamps are nitrogen limited compared to phosphorus, and dissolved inorganic nitrogen, especially nitrate, is the most important nutrient in the formation of phytoplankton blooms in Lake Maurepas. Little phosphorus appears to be retained in swamp vegetation, but instead is retained in the sediments. As long as sediment mobilization remains low, phosphorus export should remain low (Mitsch and Gosselink, 2000). Nitrogen is largely reduced by denitrification, but can also undergo substantial reductions via burial in subsiding sediments (2003). Unsteady State Hydraulic Models (UNET) (2003) predict that the Maurepas Swamp ecosystem can remove up to 95 percent of nitrogen loads from surface waters via several pathways, thus limiting potential algal blooms from freshwater diversions.

Existing Conditions. Plankton population changes may be associated with the conversion of swamp habitat to freshwater marsh and open water. Little information appears to be available on plankton communities in the swamps along the ARDC. In general, running water almost always contains free-floating microorganisms, and in large rivers or sluggish streams, many of these microorganisms are planktonic. However, these populations are unstable and subject to constant change due to variable flows, turbidity, etc. (Hynes, 1970). Such a variable plankton community, likely to be found in the ARDC, would be subject to the flows of the Amite River and tidal influences through Lake Maurepas.

Within the swamp, the plankton community would be affected by existing conditions, including the lack of hydrological connectivity with the ARDC. A lack of nutrients, combined with shading due to a forest canopy and/or the presence of floating plants (e.g., water hyacinth, salvinia, duckweed), could depress photosynthesis and, therefore, phytoplankton populations. Zooplankton populations could, in turn, be depressed.

4.2.8.2 Benthic

Historic Conditions. Construction of the ARDC resulted in dredged material berms which limits exchange of benthic organisms and water between the swamp and the ARDC. Benthic community structure is not static; it provides a residence for many sessile, burrowing, crawling, and even swimming organisms. The benthic community is a storehouse of organic matter and inorganic nutrients, as well as a site for many vital chemical exchanges and physical interactions. Major consumer groups of the benthic habitat include bacteria and fungi, microalgae, meiofauna, and microfauna (Mitsch and Gosselink, 2000). One of the main functions of a benthic community is secondary production, the conversion of plant material (formed in primary production) by benthic detritivores and herbivores to animal tissue, thereby forming major links in the aquatic food web between plants and predators (Cole, 1975).

Existing Conditions. Benthic population changes are associated with the conversion of swamp habitat to freshwater marsh and open water. Within the LCA ARDC study area, the benthic community is seasonally abundant, typically during winter months when cooler water temperatures facilitate higher DO concentrations. Organisms found in winter include a wide variety of segmented and flatworms, snails, crustaceans, and insects. During summer, when little DO is present, the benthic community is sparse, and air-breathing insects and crustaceans; a few tubificid oligochaetes and dipterans, which can tolerate lower oxygen conditions; and crawfish, especially burrowing crawfish, may be found. During periods when the swamp floor dries, these organisms survive through the production of resistance stages (eggs, cocoons, etc.) and repopulate the area when flooding of the swamp floor returns (Loden, 1978).

4.2.9 Fishery Resources

Fishery resources are institutionally significant because of the Fish and Wildlife Coordination Act of 1958, as amended; the Endangered Species Act(ESA) of 1973; the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (Magnuson-Stevens Act); the Magnuson-Stevens Reauthorization Act of 2006; the Coastal Zone Management Act; and the Estuary Protection Act. Fishery resources are technically significant because they are a critical element of many valuable freshwater and marine habitats; they are indicators of the health of various freshwater and marine habitats; and many species are commercially important. Fishery resources are publicly significant because of the high priority placed on their aesthetic, recreational, and commercial value.

National Marine Fisheries Service (NMFS), in a letter dated February 20, 2009, indicated that aquatic and wetland habitats in the LCA ARDC study area provide foraging and nursery habitat for a few economically important marine fishery

species that use freshwater habitats in this area. The species expected to be found in the LCA ARDC study area include striped mullet *(Mugil cephalus)* and Gulf menhaden *(Brevoortia patronus)*. Although the area likely provides some habitat for a few euryhaline species, it is not classified as Essential Fish Habitat (EFH) (EFH - Rick Hartman, NMFS, pers. comm.). In addition, the waterbodies and wetlands of the LCA ARDC study area provide nursery and foraging habitats supportive of a variety of fishery species, some of which may serve as prey for other fish species.

Emergent wetlands and shallow open water areas in the LCA ARDC study area provide important and essential fishery habitats including transitional habitat between freshwater and estuarine environments used by migratory and resident fish and other aquatic organisms for nursery, foraging, breeding and spawning, and other life requirements. The area historically and currently provides habitat for recreational fishing; some commercial catfishing and crabbing occurs in the Blind River and the Amite River near the LCA ARDC study area. Population trends for fishery species within the LCA ARDC study area are presented in Table 4.6 (LCWCRTF and WCRA 1999). The Amite/Blind River mapping unit has shown steady populations over the last 10 to 20 years for blue crab (*Callinectes sapidus*), largemouth bass (*Micropterus salmoides*), and channel catfish (*Ictalurus punctatus*). In the LCA ARDC study area, populations are expected to remain steady through 2050. Globally, overfishing and habitat change have resulted in the depletion of 90 percent of the world's seafood resources (Worm *et al.*, 2006). Of the species studied, 38 percent have experienced more than 90 percent depletion. Seven percent of the species studied have become extinct (Worm *et al.*, 2006).

Historic Conditions. Construction of the ARDC and dredged material berms has prevented exchange of organisms and water between the swamp and the ARDC. The fish species assemblage in the vicinity of the ARDC is primarily composed of freshwater species, with occasional transient marine and diadromous species. Laiche (1980) sampled fish at 73 different locations along the Amite River using seines. Trammel net and additional seine samples were taken in the lower portion of the river. Forty-nine species were collected in 11 collections from the middle mainstream of the river (north of the LCA ARDC study area) and 41 species were collected in 10 seine collections from the lower mainstream (near the confluence of the ARDC and the Amite River). Most of the species collected were freshwater species; however, a few transient marine species were observed or collected. The most abundant species collected were blacktail shiner (*Cyprinella venusta*), bullhead minnow (*Pimephales vigilax*), mosquitofish (*Gambusia affinis*), longear sunfish (*Lepomis megalotis*), mimic shiner (*Notropis volucellus*), blackstripe topminnow (*Fundulus notatus*), bluegill (*L. macrochirus*), and longnose shiner (*N. longirostris*).

Table 4.6. Population Trends and Projections through 2050 For Fishery Species within the Amite/Blind River Mapping Unit (LCWCRTF and WCRA, 1999)

Fishery Species	Amite/Blind Mapping Unit (Includes LCA ARDC study area)	
	Trend	Projection
Red drum	Not Applicable	Not Applicable
Black drum	Not Applicable	Not Applicable
Spotted sea trout	Not Applicable	Not Applicable
Gulf menhaden	Unknown	Unknown
Southern flounder	Not Applicable	Not Applicable
American oyster	Not Applicable	Not Applicable
White shrimp	Not Applicable	Not Applicable
Brown shrimp	Not Applicable	Not Applicable
Blue crab	Steady	Steady
Spanish mackerel	Not Applicable	Not Applicable
Largemouth bass	Steady	Steady
Channel catfish	Steady	Steady

A total of 21 species were collected in the Amite River by Lantz (1970) using rotenone and seine. Primarily freshwater species were collected, although a few transient marine species were also collected or reported. The species with the highest standing crop collected by rotenone were blue catfish (*Ictalurus furcatus*), gizzard shad (*Dorosoma cepedianum*), spotted gar (*Lepisosteus oculatus*), freshwater drum (*Aplodinotus grunniens*), channel catfish (*I. punctatus*), striped mullet, and largemouth bass. Young-of-the-year fish collected by seining (in order of decreasing abundance) included bluegill, black crappie (*Pomoxis nigromaculatus*), longear sunfish (*L. megalotis*), spotted bass (*M. punctulatus*), and largemouth bass.

Watson *et al.* (1981) used rotenone and gill nets to collect 57 species of fish in the Blind River, including 43 freshwater species, 12 estuarine species, and two diadromous species. The authors suggested the confluence of the ARDC was a point of separation between the upper and lower reaches of Blind River. The lower Blind River had the greatest species diversity, primarily due to the presence of estuarine species. The low concentrations of DO above the ARDC could be an important limiting factor in the distribution of fish.

Hastings *et al.* (1987) utilized trawls, gill nets, and rotenone to collect 67 species of fish in Lake Maurepas. Two of the sampling stations were located at the mouths of the Amite and Blind Rivers. The distributions of species were: 55 percent freshwater, 40 percent marine, and 4 percent diadromous. The salinity in Lake Maurepas was variable; during periods of higher salinities, marine species

comprised a larger component of the lake's species assemblage (Hastings *et al.*, 1987). When the salinity in the lake is higher, marine species are also more likely to be present in the Amite and Blind Rivers.

Existing Conditions. Fishery population changes are associated with the conversion of swamp habitat to freshwater marsh and open water habitat and as water quality declines. Coastal wetlands and open waters in the LCA ARDC study area provide important habitat for aquatic species. The area historically and currently provides valuable habitat for recreational fishing and nursery areas for a variety of finfish (Laiche, 1980; Watson *et al.*, 1981; Hastings *et al.*, 1987).

4.2.10 Essential Fish Habitat (EFH)

EFH is institutionally significant because of the Magnuson-Stevens Fishery Conservation and Management Act of 1996. EFH is technically significant because EFH includes "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The high value that the public places on seafood, recreational and commercial opportunities makes EFH a publicly significant resource. Specific categories of EFH include all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), including the sub-tidal vegetation (sea grasses and algae) and adjacent inter-tidal vegetation (marshes and mangroves).

The LCA ARDC study area does not contain any areas classified as EFH, although the area likely provides some habitat for a few euryhaline species (Rick Hartman, NMFS, pers. comm., March 27, 2009).

Historic Conditions. The LCA ARDC study area has never contained any areas classified as EFH. Although the area likely provides some habitat for a few euryhaline species, it is not classified as EFH (Rick Hartman, NMFS, personal communication, April 2009).

Existing Conditions. The LCA ARDC study area does not contain any areas classified as EFH. Although the area likely provides some habitat for a few euryhaline species, it is not classified as EFH (Rick Hartman, NMFS, personal communication, April 2009).

4.2.11 Threatened and Endangered Species

This resource is institutionally significant because of the ESA of 1973, as amended, and the MMPA. Endangered and threatened species are technically significant because the status of such species provides an indication of the overall health of an ecosystem. These species are publicly significant because of the desire of the public to protect them and their habitats.

The ESA of 1973 (16 USC 1531-1543) specifies that all Federal agencies are required to undertake programs for the conservation of threatened and endangered species and are prohibited from authorizing, funding, or undertaking any action that jeopardizes a species protected under the ESA or modifies its designated critical habitat. The provisions of the ESA apply only to species listed in the Federal Register as threatened or endangered.

Historic Conditions. There has been a decrease in some animal and plant populations and their critical habitat including loss of wetlands.

Federally-Listed Endangered and Threatened Species. Within the State of Louisiana, 29 animal and three plant species (some with critical habitats) are under the jurisdiction of the USFWS and NMFS that are presently classified as threatened or endangered (Table 4.7). The USFWS and NMFS share jurisdictional responsibility for sea turtles and the Gulf sturgeon. The USFWS, in a letter dated January 20, 2009, identified two threatened and endangered species (Gulf sturgeon and West Indian manatee) and one delisted species (bald eagle) that are known to occur within the LCA ARDC study area.

West Indian Manatee – The West Indian manatee is listed as endangered in Ascension Parish. The West Indian manatee occurs in shallow, slow-moving rivers, estuaries, saltwater bays, canals and coastal areas. Manatees occasionally enter Lakes Pontchartrain and Maurepas and associated coastal waters and streams during the summer months, i.e., June through September. Manatee occurrences appear to be increasing in coastal Louisiana, and sightings have been reported in the Amite, Blind, Tchefuncte, and Tickfaw rivers, and in canals within the adjacent coastal wetlands. The manatee has declined in numbers as a result of collisions with boats, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect the species.

Gulf Sturgeon - The Gulf sturgeon is listed as threatened in Ascension and Livingston Parishes. The Gulf sturgeon is anadromous and occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River in Florida. In Louisiana, Gulf sturgeon has been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain Basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon, less than two years old, appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and overfishing have negatively affected the species.

Table 4.7. Endangered (E) and Threatened (T) Plant and Animal Species in Louisiana

Species Under Jurisdiction of the USFWS Status Common Name (*Scientific Name*)	Species Under Jurisdiction of NMFS Status Common Name (*Scientific Name*)
Mammals E[1] -- Florida panther (*Felis concolor coryl*) E[1] -- Red wolf (*Canis rufus*) **E -- West Indian manatee (*Trichechus manatus*)** T -- Louisiana black bear (*Ursus americanus luteolus*) Birds E[2] -- Bachmans's warbler (*Vermivora bachmanii*) E[1] -- Eskimo curlew (*Numenius borealis*) E[1] -- Ivory-billed woodpecker (*Campephilus principalis*) E -- Least tern; interior population (*Sterna antillarum*) E -- Red-cockaded woodpecker (*Picoides borealis*) T -- Piping plover (*Charadrius melodus*) Reptiles E[3] -- Hawksbill sea turtle (*Eretomchelys imbricata*) E[3]-- Kemp's (Atlantic) Ridley sea turtle (*Lepidochelys kempii*) E[3]-- Leatherback sea turtle (*Dermochelys coriacea*) T(S/A)[4] --American alligator (*Alligator mississippiensis*) T -- Gopher tortoise (*Gopherus polyphemus*) T[3]-- Green sea turtle (*Chelonia mydas*) T[3] -- Loggerhead sea turtle (*Caretta caretta*) T -- Ringed sawback turtle (*Graptemys oculifera*) Fish E -- Pallid sturgeon (*Scaphirhynchus albus*) **T[3] -- Gulf sturgeon (*Acipenser oxyrinchus desotoi*)** Invertebrates E -- Mussel, Fat pocketbook (*Potamilus capax*) E -- Pink pearlymussel Mucket (*Lampsilis abrupta*) T -- Inflated (Alabama) heelsplitter (*Potamilus inflatus*) T -- Louisiana pearlshell (*Margaritifera hembeli*) Plants E -- American chaffseed (*Schwalbea americana)* E -- Louisiana quillwort (*Isoetes louisianensis*) T -- Earth fruit (*Geocarpon minimum*) Candidate Species[5] C -- Snake, Louisiana pine (*Pituophis ruthveni*)	Marine Mammals E -- Sperm whale (*Physeter macrocephalus*) E -- Sei whale (*Balaenoptera borealis*) E -- Humpback whale (*Megaptera novaeangliae*) E -- Finback whale (*Balaenoptera physalus*) E -- Blue whale (*Balaenoptera musculus*) Sea Turtles[3] E -- Hawksbill sea turtle (*Eretomchelys imbricata*) E -- Kemp's (Atlantic) Ridley sea turtle (*Lepidochelys kempii*) E -- Leatherback sea turtle (*Dermochelyscoriacea*) T -- Green sea turtle (*Chelonia mydas*) T -- Loggerhead sea turtle (*Caretta caretta*) Fish **T -- Gulf sturgeon (*Acipenser oxyhyinchus desotoi*)** Candidate Species[5] Dusky shark (*Carcharhinus obscurus*) Sand tiger shark (*Odontaspis taurus*) Night shark (*Carcharinus signatus*) Speckled hind (*Epinephelus drummondhayi*) Saltmarsh topminnow (*Fundulus jenkensi*) Jewfish (*Epinephelus itajara*) Warsaw grouper (*Epinephelus striatus*)

[1] Florida panther, red wolf, Eskimo curlew, and ivory-billed woodpecker presumed extirpated in the state.

[2] No confirmed sightings of Bachman's warbler on U.S. nesting grounds since mid-1960s. Species may be extirpated in Louisiana.

[3] USFWS and NMFS share jurisdictional responsibility for sea turtles and the Gulf sturgeon.

[4] Alligator in Louisiana is classified for law enforcement purposes as "Threatened due to Similarity of Appearance." They are biologically neither endangered nor threatened. Regulated harvest is permitted under state law.

[5] Candidate species are not protected under the ESA, but concerns regarding their status indicate they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

Legend: E=Endangered; T= Threatened; C=Candidate
Species in bold type are those potentially found within the LCA ARDC study area

On March 19, 2003, the USFWS and NMFS published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Within Louisiana, this critical habitat includes portions of the Pearl and Bogue Chitto rivers, Lake Pontchartrain east of the Greater New Orleans Expressway Commission Causeway, Little Lake, the Rigolets, Lake St. Catherine, and Lake Borgne. Gulf sturgeon have been observed in waterbodies within the LCA ARDC study area; however, these waterbodies are not within the critical habitat.

Louisiana State Rare, Threatened, and Endangered Species and Natural Communities. The LNHP, founded in 1984 through a partnership with the State of Louisiana and The Nature Conservancy, is maintained by the LDWF. The LNHP was founded with the goal of developing and maintaining a database on rare, threatened and endangered species of plants and animals, and natural communities for Louisiana. According to the database, 21 species and natural communities (Table 4.8) occur in Ascension and Livingston Parishes. The USFWS, in a letter dated October 15, 2008, also noted that the proposed LCA ARDC study area is known to support colonial nesting waterbirds.

Table 4.8. Rare, Threatened, and Endangered Species and Natural Communities Tracked by the LNHP, Ascension and Livingston Parishes-January 2010

Scientific Name	Common Name	State Rank[1]
Acipenser oxyrinchus desotoi	Gulf sturgeon	S1S2/Threatened
Aimophila aestivalis	Bachman's sparrow	S3
Alosa alabamae	Alabama shad	S1
Bottomland hardwood forest	Bottomland hardwood forest	S4
Cypress-tupelo swamp	Cypress-tupelo swamp	S4
Haliaeetus leucocephalus	Bald eagle	S2N,S3B/Endangered
Hemidactylium scutatum	Four-toed salamander	S1
Lampsilis ornata	Southern pocketbook	S3
Mustela frenata	Long-tailed weasel	S2S4
Ophisaurus ventralis	Eastern glass lizard	S3
Picoides borealis	Red-cockaded woodpecker	S2
Potamilus inflatus	Inflated heelsplitter	S1/Threatened
Rhadinaea flavilata	Pine woods snake	S1
Rhynchospora miliacea	Millet beakrush	S2
Sorex longirostris	Southeastern shrew	S2S3
Spilogale putorius	Eastern spotted skunk	S1
Spruce pine-hardwood mesic flatwoods	Spruce pine-hardwood mesic flatwoods	S2
Stewartia malacodendron	Silky camellia	S2S3
Trichechus manatus	West Indian manatee	SZN/Endangered
Trichomanes petersii	Dwarf filmy-fern	S2
Waterbird nesting colony	Waterbird nesting colony	SNR

[1]State Element Ranks: S1 = critically imperiled in Louisiana because of extreme rarity; S2 = imperiled in Louisiana because of rarity; SZ = transient species in which no specific consistent area of occurrence is identifiable; B = breeding occurrence; N = nonbreeding occurrence; S? = rank uncertain.
Source: http://www.wlf.louisiana.gov/experience/naturalheritage/rarespeciesandparishhabitats/)

Existing Conditions

Federal Designation. Two animals under the Federal jurisdiction of the USFWS and/or the NMFS, presently classified as endangered or threatened are within the LCA ARDC study area (Table 4.9).

Table 4.9. Threatened and Endangered Plant and Animal Species in the LCA ARDC Study Area (LNHP, 2008)

Species	Critical Habitat	Status		Jurisdiction	
		Federal	State	USFWS	NMFS
LISTED SPECIES					
Red-cockaded woodpecker (*Picoides borealis)*		E	E	X	
West Indian manatee (*Trichechus manatus*)		**E**	**E**	**X**	
Gulf sturgeon (*Acipenser oxyrhynchus desotoi*)		**T**	**T**	**X**	**X**
Alabama shad (*Alosa alabamae*)		C	S1	X	
Inflated heelsplitter (*Potamilus inflatus*)		T	T	X	
RARE SPECIES					
Bachman's sparrow (*Aimophila aestivalis*)			S3		
Dwarf filmy fern (*Trichomanes petersii*)			S2		
Eastern glass lizard (*Ophisaurus ventralis*)			S3		
Eastern spotted skunk (*Spilogale putorius*)			S1		
Four-toed salamander (*Hemidactylium scutatum*)			S1		
Long-tailed weasel (*Mustela frenata*)			S2S4		
Millet beakrush (*Rhynchospora miliacea*)			S2		
Pine woods snake (*Rhadinaea flavilata*)			S1		
Silky camellia (*Stewartia malacodendron*)			S2S3		
Southeastern shrew (*Sorex longirostris*)			S2S3		
Southern pocketbook (*Lampsilis ornata*)			S3		

Notes: Species with occurrences within LCA ARDC study area as documented by USFWS and/or LNHP are denoted by a **bold** font.

Status: E-Endangered; T-Threatened; C-Candidate; D-Delisted; S1-Critically imperiled in LA; S2-Imperiled in LA; S3-Rare and local throughout LA; S4-Apparently secure in LA; SR-Reported in LA

State Designation. The LNHP maintains a database of rare, threatened, and endangered species of plants, animals, and natural communities for Louisiana. The LNHP lists 11 rare species within Ascension and Livingston Parishes that may potentially be present within the LCA ARDC study area (Table 4.8). Additionally, the LNHP lists the following species or rare elements as occurring in the LCA ARDC study area:

- Bald cypress-tupelo swamp habitat,

- A bald eagle nest; and
- Two great blue heron rookeries.

4.2.12 Cultural and Historic Resources

This resource is institutionally significant because of NEPA and the National Historic Preservation Act of 1966 (NHPA). This resource is technically significant due to the importance of protection and conservation of traditional cultural resources, historic buildings and structures, and other valued cultural resources. This resource is publicly significant because the public demands the preservation of cultural resources.

Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by ACHP. Revised regulations, "Protection of Historic Properties" (36 CFR Part 800), became effective January 11, 2001.

The State Historic Preservation Office (SHPO) administers the national historic preservation program at the state level, reviews National Register of Historic Places nominations, maintains data on historic properties that have been identified but not yet nominated, and consults with Federal agencies during Section 106 review. The two historic properties located within the LCA ARDC study area are the ARDC (Division of Archeology site number 16LV103/16AN84) and the abandoned railroad grade (Division of Archeology site number 16LV102).

The ARDC is a 10.6 mi. long artificial channel that extends from the Amite River at Mile 25.3 to Mile 4.8 of the Blind River in Ascension and Livingston Parishes (see Figure 1.2). The ARDC is recommended not eligible for National Register of Historic Places (NRHP) nomination. While a number of historic canals are NRHP listed—the Chesapeake and Ohio Canal, the Delaware Canal, and the Ohio and Erie Canal for example—the significant examples are typically pre-20th century transportation features that contributed significantly to their region's historic economy and, in some cases, also represent significant engineering innovations or feats. In contrast, the ARDC is one of a number of similarly constructed post WW II canals that were simply designed to improve flood control and drainage. Other examples in the immediate vicinity include the Chinquapin Canal and the New River Canal.

The abandoned railroad grade is an 8 km long linear feature within the LCA ARDC study area (see Figure 1.2). It extends south from the Chinquapin Canal, across Chene Blanc Bayou and the ARDC, and then turns east as it approaches the Blind

River. Additionally, it extends north and south of the LCA ARDC study area in the adjoining swamps that are beyond the LCA ARDC study area.

The old railroad grade is recommended not eligible for NRHP nomination. Abandoned railroad grades that are associated with the historic lumber industry are ubiquitous in Louisiana. The old grade represents only a portion of the former railroad infrastructure, and it has been modified by the removal of the wooden ties and steel rails.

Historical Conditions. Cultural resources have been subject to natural and man-made processes. Recorded archival and historical research was conducted to develop a baseline level of knowledge for prehistoric and historic period cultural developments and to identify archeological and historical sites previously recorded in the LCA ARDC study area. Among the research efforts, a review of historical literature and previous archeological investigation reports yielded information useful for developing a general chronology of cultural developments across the region.

Existing Conditions. Human activities, as well as natural processes, can potentially destroy historic and natural resources. The loss of land threatens the existence and integrity of these resources. An inventory of identified cultural resource sites within the LCA ARDC study area was compiled through database and paper map searches located at the SHPO. The SHPO manages these resources through the Divisions of Archaeology and Historic Preservation for use during the Section 106 Review process. The Division of Archaeology houses records of archaeological resources both on USGS 7.5-minute series quadrangle maps and a confidential cultural resources geodatabase layer. Cultural affiliation, National Register status, and other descriptive details of the archaeological sites are recorded on site forms stored at the Division. Information concerning areas previously surveyed for cultural resources depicted on parish-wide street maps and the corresponding reports can also be obtained from the Division of Archaeology. Standing structure forms are managed by the Division of Historic Preservation and are housed at the Louisiana State Library. These forms record data providing National Register status, structural details, historical significance, and photographs of the surveyed structure. Locations and ownership information for these standing structures are also maintained in a public cultural resources geodatabase layer.

Preliminary archival research of recorded cultural resources in the geodatabase layers and USGS quadrangle maps identified five archaeological sites within or immediately adjacent to the LCA ARDC study area, including a mound site on the Bayou Chene Blanc bankside, shell middens on Bayou Chene Blanc (two sites) and ARDC (one site north of the LCA ARDC study area) banksides, and a shell midden and prehistoric scatter on the lower Amite River bankside (Table 4.10). The mound site on Bayou Chene Blanc could not be located and is

presumed to be destroyed. While these sites are located within the vicinity of the LCA ARDC study area, no impact to these identified sites is anticipated from project activities. No standing structures were identified within or immediately adjacent to the LCA ARDC study area during preliminary archival research. No archaeological sites were located at the five proposed cuts.

Table 4.10. Identified Archaeological Sites Within the LCA ARDC Study Area (SHPO, 2008)

Site ID No.	Description	Location	Comments	NRHP Status
16LV91	Destroyed mound site	Bayou Chene Blanc bankside	Possible camp site	Eligible
16LV92	Shell midden	Bayou Chene Blanc bankside	Possible camp site	Potentially eligible
16LV93	Shell midden	Bayou Chene Blanc bankside	Possible camp site	Potentially eligible
16LV5	Shell midden and prehistoric scatter	Amite River bankside	Possible prehistoric hamlet or village	Eligible
16AN16	Shell midden	ARDC bankside	Possible prehistoric hamlet or village	Unknown

On October 19, 2009, Panamerican Consultants Inc. performed a cultural resources survey of the five proposed cuts in the ARDC. No archeological sites were located at five proposed cuts, but one modern Rangia scatter was observed near cut 5. The Rangia scatter was considered an insignificant finding. The two historic properties located within the LCA ARDC study area are the ARDC (Division of Archeology site number 16LV103/16AN84) and the abandoned railroad grade (Division of Archeology site number 16LV102). Both of these sites are ineligible for the National Register of Historic Places.

A letter of SHPO concurrence with these findings was received January 2010 (Appendix F). This letter states that the office concurs with the findings. It does not appear that any significant archeological sites or historic properties will be affected by the proposed project. Therefore, cultural resources need not be further considered during pursuit of the project for which the investigations were conducted.

In accordance with ER 1105-2-100, Appendix C, paragraph C-4(d)(5)(d)(2), the U.S. Army Corps of Engineers (USACE) elected to fulfill its obligations under Section 106 of the National Historic Preservation Act of 1966, as amended, through

the execution and implementation of a Programmatic Agreement. In consultation with the Advisory Council on Historic Preservation (ACHP), Louisiana State Historic Preservation Officer (SHPO), Indian tribes, representatives of local governments, and other consulting parties, the USACE developed a Programmatic Agreement among the USACE, Coastal Protection and Restoration Authority of Louisiana, SHPO, and ACHP, pursuant to 36 CFR § 800.14(b)(1) (Appendix F). The Programmatic Agreement establishes the procedures for consultation, identification of historic properties, assessment and resolution of adverse effects.

4.2.13 Aesthetics

This resource is institutionally significant because of the Natural and Scenic River Systems and the National Wild and Scenic Rivers System created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 *et seq*.) Aesthetics is technically significant because the visual complexity provides an indication of the overall health of an ecosystem. Aesthetics are publicly significant because of the desire of the public to protect habitats and viewscapes.

Historic Conditions. The streams of the project area were essentially what they are today, and there were no canals. The streams were not seen by many people because the area was remote and opportunities for fishing and boating were widespread for people in the major population centers such as Baton Rouge and New Orleans. The project area was a virgin forest before it was clear cut in the early 1900s. However, the interior swamps would have been seen only by a few trappers. The logging operations decimated the swamps, which subsequently were recovering from an aesthetic perspective until the construction of the ARDC introduced new conditions of decline and cut across some of the existing streams such as the Petite Amite River. However, one of the major effects of the ARDC was to open the project area to a high level of visitation and enjoyment.

Louisiana Scenic Rivers and Streams. The Louisiana Natural and Scenic River System is one of the Nation's largest, oldest, most diverse and unique state river protection initiatives (Louisiana State University [LSU] Agricultural Center, 2009). It encompasses over 80 streams or stream segments including over 3,000 linear miles (4,827 km) of Louisiana's streams, rivers, and bayous (LDWF, 2005). The streams in the system vary from fast flowing upland streams with riffles and waterfalls to sluggish swamp bayous flanked by Spanish moss draped cypress trees to brackish water tidal creeks in the coastal marshes. A natural or scenic river is a river, stream, or bayou that is in a free-flowing condition and has not been altered by channelization or realignment (Louisiana Scenic Rivers Act [LSRA] - Acts 1988, No. 947, § 1, eff. July 27, 1988). A stream can also be classified as scenic if it has been altered, but contains native vegetation and has little or no manmade structures along its bank. The LDWF administers the Louisiana Natural and Scenic Rivers system established in 1970 for the purpose of preserving, developing,

reclaiming and enhancing the wilderness qualities, scenic beauties and ecological regime of designated free-flowing waterbodies. The LCA ARDC study area is made up mostly of open water marshes, swamps and bayous. Blind River is a designated scenic river located adjacent to the LCA ARDC study area.

Existing Conditions

Streams and Canals - The primary streams in the project area are the Petite Amite River, Blind River, Little Bayou Chene Blanc, and Bayou Chene Blanc. All of these streams are placid, run through swamps, have low banks that allow views into the immediate interior, and are occasionally fringed by large cypress trees that were too decayed or deformed to harvest. The water is generally clean and free of debris and obstructions, with the exception of rapidly spreading *Salvinia* sp. that stretches across portions of the Petite Amite River and the Blind River and forms a solid mass on the Blind River before its confluence with the Petite Amite River. The Blind River is a designated Wild and Scenic River, a status suggestive of its aesthetic qualities.

The two canals in the project area are the Chinquapin Canal and the ARDC. The Chinquapin Canal runs through swamp and is straight and narrow, with dredged materials placed on the north bank and the south open to views of the swamp. It is generally clean and free of debris until nearing Berthelot's Campground.

The primary feature of the ARDC from an aesthetic perspective is its large bank-to-bank size and a length that establishes a sense of vista, whether viewed from a boat, a bridge, or a residence. Housing on the north side of the canal in Riverfront East is elegant, with manicured yards. Campsites on the south side in Three Rivers Island are architecturally varied and rise to greater heights than the homes on the north side, providing visual contrast. Residents enjoy sitting in their back yards simply to view the water.

Swamps and Ridges - Apart from Berthelot's Campground, the small strip of housing and campsite development on the ARDC, and the old railroad grade, most of the project area is composed of swamps and ridges. The ridges are small rises in the swamp and are occupied by water oak, diamond oak, sweetgum, ash, wax myrtle, black willow, Chinese tallow, and privet. They provide an idyllic setting in contrast to the surrounding darkness and wetness of the swamps and a welcome relief for hunters, nature observers, bird watchers, and ecologists.

From an aesthetic perspective, the swamps of the project area can be characterized as either healthy or degraded. The healthy areas have a fairly dense canopy constituted by bald cypress and water tupelo trees. The baldcypress are not majestic because the original trees were removed by logging operations in the early

1900s. The understory, which is not dense, is composed primarily of swamp red maple and green ash. The ground is hard bottom. The swamps are perennially wet, but the water is clear. The setting is tranquil and shaded.

The degraded swamps, which were formerly of the bald cypress-tupelo type, are located in the low interior areas as the elevations decrease away from the ridges and dredged material deposits. The canopy has largely or completely disappeared, eliminating the shading in the surrounding swamp. The ground is bog-like, with a danger of sinking past hip boots, and the water is covered with green floating scum. There is a strong odor that smells like decayed matter. The degraded swamps are decidedly unpleasant from an aesthetic perspective.

View Sheds. The Blind River, Little Bayou Chene Blanc, Bayou Chene Blanc, and the scenic portions of the Petite Amite River are only observable by boat within the project area. The Chinquapin Canal is observable from land but only through streets in Berthelot's Campground that are separated from the canal by private properties. The only expansive view of the ARDC (other than by boat) is from the Hwy. 22 bridge by automobile, but the view is of short duration because it is dangerous to stop on the bridge.

There are no public views of the interior of the swamps, which are seen only by a small number of hunters (fewer than 40). The only public thoroughfare in and around the project area is the ARDC, which is used by recreational boaters. The view sheds for this portion of the project area include the areas surrounding the dredged material berm and minimal areas within the interior swamp. These views are made up mostly of the development along the banks of the canal and some overgrown portions of the bank; therefore, a majority of the impacts that occur within the project area would not be noticeable from these view sheds.

4.2.14 Recreation

This resource is institutionally significant because of the Federal Water Project Recreation Act of 1965, as amended, and the Land and Water Conservation Fund Act of 1965, as amended. Recreational resources are technically significant because of the high economic value of recreational activities and their contribution to local, state, and national economies. Recreational resources are publicly significant because of the high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana, and the large per-capita number of recreational boat registrations in Louisiana.

Historic Conditions. Recreation activities in the LCA ARDC study area are centered on natural resources. There was little in the way of recreational activities in the LCA ARDC study area historically because the area was remote and opportunities for boating, fishing, and hunting were widespread for people in

the major population centers such as Baton Rouge and New Orleans. Usage of the streams for boating and fishing developed gradually as the quality and range of recreational boats increased, and usage of the swamps for hunting developed gradually as resources near population centers became scarcer. However, there was a burst of recreation activity during the post-war economic expansion, which provided the resources and leisure for higher levels of recreational participation. The construction of the ARDC opened the area for those higher levels of participation.

Existing Conditions. Recreation activities in the LCA ARDC study area are centered on the area's natural resources. The waterways within and comprising the boundaries of the LCA ARDC study area are used extensively for recreational purposes. According to the LDWF (personal communication), the most important of these activities is pleasure boating, followed by fishing and then by hunting. Water access is available from private docks along the waterways and from public and private boat ramps.

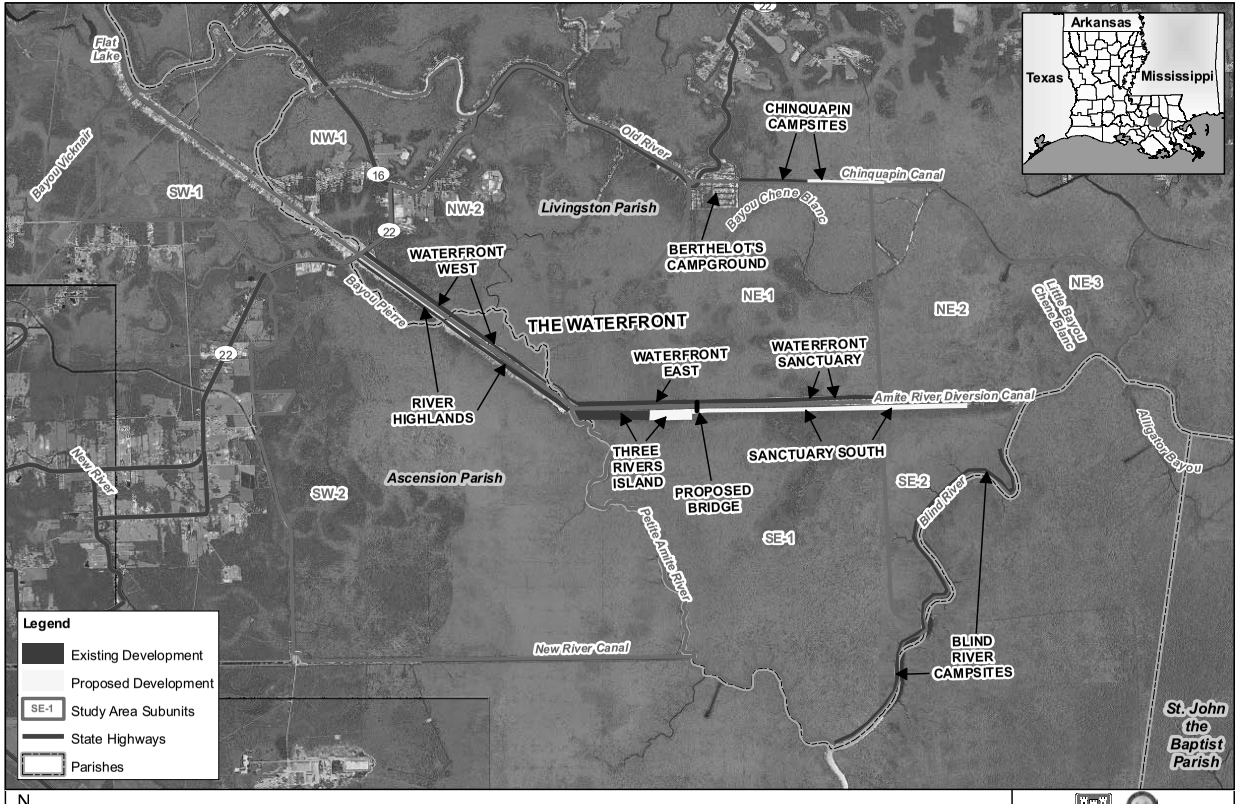
4.2.15 Socioeconomics and Human Resources

This resource is institutionally significant because of NEPA; the Estuary Protection Act; the CWA; the River and Harbors Acts; the Watershed Protection and Flood Protection Act; and the Water Resources Development Acts. Of particular relevance is the degree to which the proposed action affects public health, safety, and economic well-being; and the quality of the human environment. This resource is technically significant because the social and economic welfare of the nation may be positively or adversely impacted by the proposed action. This resource is publicly significant because of the public's concern for health, welfare, and economic and social well-being from water resources projects.

The *Final Programmatic Environmental Impact Statement* (FPEIS) for the *Louisiana Coastal Area (LCA) Louisiana Ecosystem Restoration Study* is incorporated by reference. The FPEIS deals with the whole of the coastal area and therefore does not contain information specific to the LCA ARDC study area. The FPEIS points out that water has traditionally acted as an attractant for settlement. This is also the situation in the LCA ARDC study area.

4.2.15.1 Population and Housing

Historic Conditions. The Chinquapin Canal was constructed in the 1950s by the Livingston Parish Department of Public Works with the assistance of the State of Louisiana and discharges water from Old River into Bayou Chene Blanc. Berthelot's Campground was developed in the 1960s at the intersection of the canal and the river (Figure 4.9). The campground was developed on both sides of the canal and displayed a typical subdivision street pattern. Other than


Arkansas
Texas
Mississippi
Flat Lake
Bayou Vidrine
NW-1
SW-1
NW-2
16
22
Livingston Parish
Old River
CHINQUAPIN CAMPSITES
Chinquapin Canal
Bayou Chene Blanc
BERTHELOT'S CAMPGROUND
WATERFRONT WEST
Bayou Pierre
THE WATERFRONT
NE-1
NE-2
NE-3
Little Bayou Chene Blanc
WATERFRONT EAST
WATERFRONT SANCTUARY
Amite River Diversion Canal
RIVER HIGHLANDS
THREE RIVERS ISLAND
PROPOSED BRIDGE
SANCTUARY SOUTH
Alligator Bayou
New River
Ascension Parish
SW-2
SE-2
Blind River
Petite Amite River
SE-1
New River Canal
BLIND RIVER CAMPSITES
St. John the Baptist Parish
Legend
Existing Development
Proposed Development
SE-1
Study Area Subunits
State Highways
Parishes
N
0 0.5 1 1.5 2
Miles
EXISTING AND PROPOSED DEVELOPMENT NEAR THE LCA-ARDC STUDY AREA
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 4.9
Date: October 2009
Scale:1:80,000
Source: NAIP/GEC
Map ID: 27850108-1790

Berthelot's Campground, the LCA ARDC study area has had little in the way of population or housing. Development along the dredged material berms has occurred, leading to an increase in population and residential housing within the LCA ARDC study area.

Existing Conditions. Development in the LCA ARDC study area is generally along the ARDC, Amite and Blind Rivers and on ridges (Figure 4.9). The LCA ARDC study area is located within an area that historically has been known as Maurepas Island, which is bounded on the north by the Amite River, on the west by Bayou Pierre, on the south by the Petite Amite and Blind rivers, and on the east by Lake Maurepas. This designation was apparently used from the earliest settlement period, because it appears in Act 95 of the 1850 Louisiana Legislature, which transferred the island from Ascension Parish to Livingston Parish.

The community of Head of Island, which is on the Amite River immediately west of the LCA ARDC study area, was so named because it is at the head of this island. The English name and its suggestion of upstream movement indicate that it was a late landing for boats, although it may have been a stopping place as early as the 1700s. Mary Ann Sternberg in *Winding Through Time: The Forgotten History and Present-Day Peril of Bayou Manchac* indicates that Head of Island was a landing for steamboats from New Orleans from at least 1868, and it begins to appear on maps in the 1870s.

The newer housing developments that constitute the distinctive feature of the ARDC did not begin until the present decade, with Blind River Properties as one of the major developers. The Blind River Properties is the largest property holder in the LCA ARDC study area and its environs. The Blind River Properties owns 32,806 acres along the southwest shore of Lake Maurepas, along both banks of Blind River, and along the ARDC (Annie Fugler, "Boat-ing in Your Own Backyard," *Livingston Business and Real Estate Journal*, August 2006, pp.7-9). Approximately 85 to 90 percent is clear cut bald cypress swamp. The balance consists of higher elevations along various oak ridges, lake shore banks, and canal dredged material areas.

4.2.15.2 Employment and Income

Historic Conditions. In the past, employment within the LCA ARDC study area was less than current figures due to limited population and business. Income levels were also lower than present, due to the socioeconomic makeup of the local residents. An increase in development has led to increased incomes and employment. Census information is difficult to interpret for the LCA ARDC study area due to the differential between the size of the census block and the LCA ARDC study area.

Existing Conditions. The permanent-resident population of Berthelot's Campground is about 180. About half of the adults are retired. The non-retired permanent residents work in Baton Rouge, Denham Springs, Gonzales, and the plants along the Mississippi River. The permanent-resident population of Waterfront East is about 247. About 30 percent of the adults are retired. The non-retired permanent residents work in Baton Rouge, New Orleans, and Denham Springs. The permanent-resident population of Three Rivers Island is about 23, mostly single persons working at the industrial facilities on the Mississippi River. The unemployment rate was 7.2 percent for Livingston Parish in July 2009. There is nothing to indicate that the permanent residents of the project area are experiencing any particular difficulties with respect to employment, although for sale signs suggest that many were affected by the downturn in the housing market.

Berthelot's Campground is populated by middle income persons, with some low income persons. Waterfront East, and particularly the Sanctuary, is populated by high income persons. The Three Rivers Island Campground is populated by middle to upper income persons.

4.2.15.3 Community Cohesion

Historic Conditions. Berthelot's Campground was a well defined community with good community cohesion since the 1960s. No other communities existed in the LCA ARDC study area. Therefore, there were no other issues affiliated with community cohesion.

Existing Conditions. The LCA ARDC study area is populated along the ARDC, Amite and Blind Rivers, and on adjacent ridges. Community cohesion must be addressed from the perspective of the LCA ARDC study area and the individual communities within the LCA ARDC study area. The three communities within the LCA ARDC study area are Berthelot's Campground, Waterfront East, and Three Rivers Island. The Blind River Campsites should not be considered a potential community because only one camp has been established. The three communities are internally homogeneous and not related to each other.

4.2.15.4 Environmental Justice

Environmental Justice (EJ) is institutionally significant because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, and Pacific Islander. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or

is meaningfully greater than in the general population. Low-income populations as of 2000 are those whose income are $22,050.00 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a Census tract with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This is updated annually at **http://aspe.hhs.gov/poverty/09poverty.shtml**. This resource is technically significant because the social and economic welfare of minority and low-income populations may be positively or disproportionately impacted by the proposed actions. This resource is publicly significant because of public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies, and actions.

A potential disproportionate impact may occur when the percent minority (50 percent) and/or percent low-income (20 percent) population in an EJ LCA ARDC study area are greater than those in the reference community. For purposes of this analysis, all Census Block Groups within a one mile radius of the project footprint are defined as the EJ LCA ARDC study area. Livingston Parish, of which the LCA ARDC Modification project is located, is considered the reference community of comparison, whose population is therefore considered the EJ reference population for comparison purposes. Parish figures were used for unincorporated areas located within one mile of the proposed project footprint.

The methodology, consistent with E.O. 12898, to accomplish this Environmental Justice analysis includes identifying low-income and minority populations within the LCA ARDC project area using up-to-date economic statistics, aerial photographs, 2000 U.S. Census records, Environmental Systems Research Institute, Inc. (ESRI) estimates, as well as conducting community outreach activities such as public meetings. Despite the 2000 U.S. Census being nine years old, it serves as a logical baseline of information and is the primary deciding variable per data accuracy and reliability for the following reasons:

- Census 2000 data is the most accurate source of data available due to the sample size of the Census decennial surveys. With one of every six households surveyed, the margin of error is negligible.

- The Census reports data at a much smaller geographic level than other survey sources, providing a more defined and versatile option for data reporting.

- Census information sheds light upon the demographic and economic framework of the area pre-Hurricane Katrina. By accounting for the

absent population, the analysis does not exclude potentially low income and minority families that wish to return home.

Due to the considerable impact of Hurricane Katrina upon the New Orleans metropolitan area, and the likely shift in demographics and income, the 2000 Census data are supplemented with more current data, including 2007 and 2008 estimates provided by ESRI. The 2007 and 2008 estimates are utilized for reference purposes only to show changing trends in population since 2000.

Historic Conditions. The concept of "environmental justice" is rooted in Title VI of the Civil Rights Act of 1964, which prohibited discrimination based on race, color and national origin, and other nondiscrimination statutes as well as other statutes including the National Environmental Policy Act of 1969, the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, and 23 U.S.C Section 109 (h). In 1971, the Council on Environmental Quality's (CEQ) annual report acknowledged racial discrimination adversely affects the environment of the urban poor. During the next ten years, activists maintained that toxic waste sites were disproportionately located in low-income and areas populated by "people of color." By the early 1980s, the environmental justice movement had increased its visibility and broadened its support base (Commission for Environmental Equality 2009).

This led to the United Church of Christ (UCC) undertaking a nationwide study and publishing Toxic Waste and Race in the United States (UCC 1987). This eventually gained the attention of the Federal government, and in 1992, the U.S. Environmental Protection Agency's (EPA's) Office of Environmental Equity was established. In 1994, EJ was institutionalized within the Federal government through Executive Order 12898 (EPA 1995a), which focused Federal attention on human-health and environmental conditions in minority and low-income communities (EPA 1995a, 1995b, 1995c, 1995d).

Executive Order 12898 requires greater public participation and access to environmental information in affected communities. The results of early efforts and research (UCC 1987) into EJ suggested that environmental amenities and toxic waste sites were not uniformly distributed among income groups, classes, or ethnic communities. Disparities of this nature may have been and continue to be the result of historical circumstances, lack of community participation, or simply inadequate or inappropriate oversight. Consequently, dialogue with some community groups were not conducted and their concerns not considered in the decision making process on local or Federal actions.

Existing Conditions. The proposed LCA ARDC Modification project area follows the boundary of the Petite Amite River which borders Ascension and Livingston Parishes in Louisiana. The LCA ARDC Modification project area is primarily

freshwater swamp that is sparsely populated, with a few residential streets and businesses in the northwestern section of the project boundary as well as residences along the Amite River Diversion Canal.

According to the 2000 U.S. Census, the LCA ARDC Modification project boundary for Livingston Parish is located within census tract 409.2, and has not changed from 2000 to 2008. The 2000 Census records indicate that the minority population in Livingston Parish was 6.3 percent and the low-income population was 11.4 percent. According to 2008 ESRI estimates (ESRI 2008), 8.2 percent of the population was minority and the 2007 ESRI estimates indicate 10.8 percent of the population was low income. The percentage of the population that is minority and low-income in Livingston Parish is significantly lower than state figures. Per the 2000 U.S. Census data, the LCA ARDC Modification project area was not a minority and/or low income community in 2000.

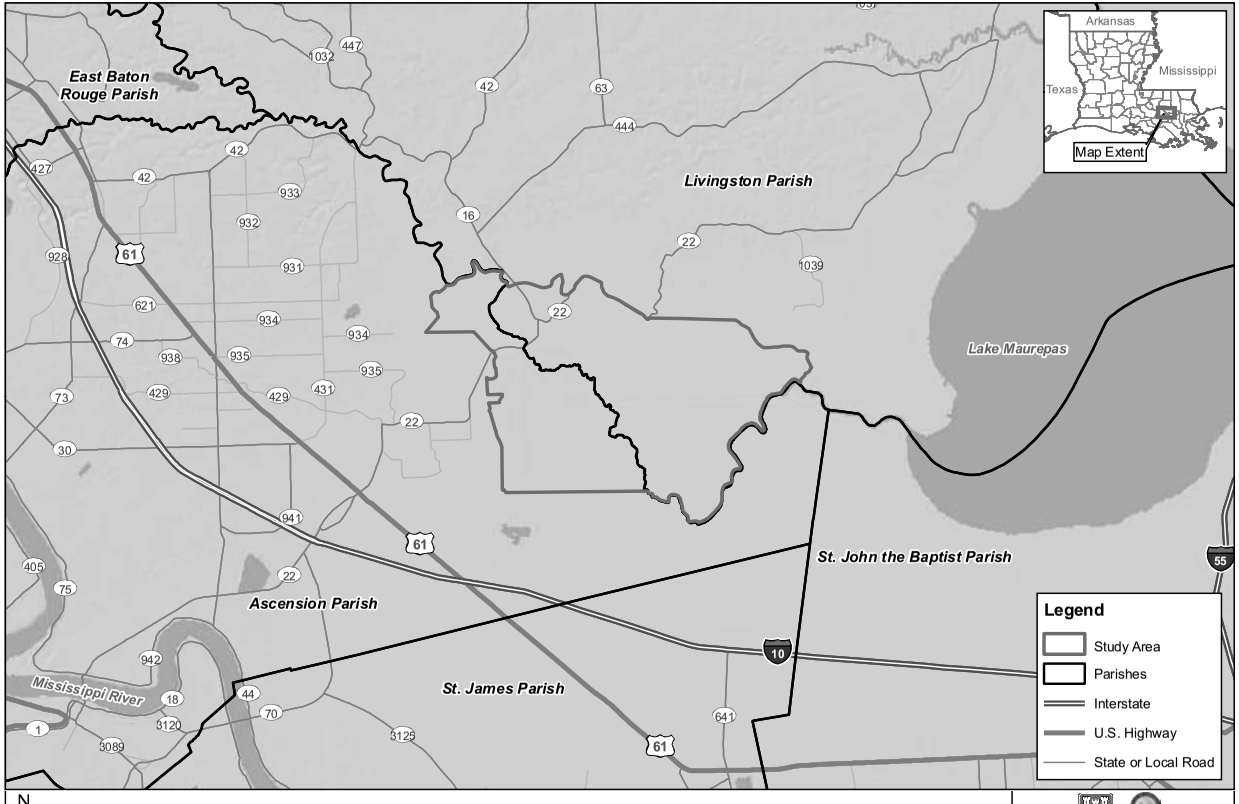
4.2.15.5 Infrastructure

Historic Conditions. Little in the way of highway development existed within the LCA ARDC study area until the 1950s, at which time LA-22 was constructed (Figure 4.10). The increase in development along the dredged material berms has led to the development of additional access roads and bridges associated with these new communities.

Existing Conditions. Plans for a proposed development along the right descending bank of the ARDC east of the Petite Amite River (as presented in Coastal Use Permit Application P20060256 [DOA Permit Application MVN-2006-1335-CZ]) include a new residential access road along the right descending bank (2.7 miles) and a new bridge that would traverse the ARDC at an elevation of 26 ft National Geodetic Vertical Datum of 1929 (NGVD 29), approximately 1.5 miles east of the Petite Amite River (subunit SE-1), for access to the new development. Two 20-foot by 40-foot bridge crossings are proposed along the new residential access road to coincide with proposed locations for dredged material berm cuts. Additionally, the U.S. Coast Guard has proposed the construction of a new bridge across the ARDC at Mile 3.37, near Head of Island, Louisiana (subunits NW-2/SW-2). The bridge would be accessed by Homeport Drive and would provide access to waterfront developments along the ARDC.

4.2.15.6 Business and Industry

Historic Conditions. Within the LCA ARDC study area, little in the way of business and industry existed over the last 100 years. Some businesses, including boat launches, bars, and restaurants have formed as a result of population and housing increases and added infrastructure.



HIGHWAYS NEAR THE LCA-ARDC STUDY AREA

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 4.10
Date: January 2010
Scale: 1:220,000
Source: ESRI/GEC
Map ID: 27850108-1793

Existing Conditions. Businesses are generally retail stores and restaurants. There are only six businesses in the LCA ARDC study area, of which five are located in Berthelot's Campground. Val's marina, bar, restaurant, and grocery is an old establishment on LA- 22 at the west entrance to the campground and is oriented toward the campground and campsites along Old River. D&J's bait shop is run out of a home and serves campground residents as well as nearby launches. There are two unnamed sinker cypress lumber mills that mill submerged logs from bayous and lakes of the region. There is also an unnamed Recreational Vehicle (RV) park that contains six covered spaces. The Blind River Bar is located within the LCA ARDC study area south of the ARDC at its confluence with the Blind River and is accessible only by water. This is the only business in the LCA ARDC study area other than the businesses in Berthelot's Campground.

There are no businesses in Waterfront East, Three Rivers Island, and the Blind River Campsites. However, there are three areas of new businesses contiguous to the LCA ARDC study area that are important to Waterfront East and Three Rivers Island and the general area of the ARDC.

4.2.15.7 Traffic and Transportation

Historic Conditions. Little to no traffic and transportation existed within the LCA ARDC study area until the 1950s, at which time LA-22 was constructed (Figure 4.10). The increase in development along the dredged material berms has led to additional vehicular traffic associated with these new communities. Boat traffic has also increased as a result of increased development, and the construction of the ARDC and the Chinquapin Canal in the 1950s and 1960s, respectively.

Existing Conditions. State and local roads traverse the LCA ARDC study area. Traffic is generally confined to residents and recreational visitors. Louisiana Highways 22 and 16, which were blacktopped in the 1950s, are the major roads in the vicinity of the LCA ARDC study area. The roads in the LCA ARDC study area are residential access roads. Berthelot's Campground contains a subdivision street pattern. Waterfront East, including The Sanctuary, is served by a single road (Waterfront East Drive) that parallels the ARDC and runs in back of the homes on the canal. Waterfront East Drive is accessed through Homeport Drive, which serves a similar function for Waterfront West and connects with LA-22. Three Rivers Island is served by a golf cart path that parallels the ARDC and runs in back of the camps on the canal. The golf cart path is accessed by River Highlands Drive, which serves a similar function for the River Highlands development and connects with LA-22. There is no vehicular access to the Blind River Campsites.

4.2.15.8 Public Facilities and Services

Historic Conditions. Little to no public facilities and services existed within the LCA ARDC study area until increases in development along the dredged material berms occurred. With these developments, public services such as wastewater treatment, water service, and electricity were implemented.

Existing Conditions. Public facilities and services generally serve residents and recreational visitors. The LCA ARDC study area is not serviced by a municipal sewer system. Wastewater Treatment of Louisiana, Inc. provides sewer service to the two existing Blind River Properties developments along the left descending bank of the ARDC. Those properties within the LCA ARDC study area not receiving sewer service from private companies use septic systems for treatment and disposal of sewage. DOA Section 10/404 Permits for the two existing Blind River Properties developments on the left descending bank of the ARDC identify the locations of four existing sewer treatment facilities (approximately 0.2, 0.5, and 2.0 miles southeast of LA-22 and 2.2 miles east of the Petite Amite River) and six sewer pump stations (approximately 0.2, 0.5, 1.0, 1.3, 1.7, and 2.0 miles southeast of LA-22). A proposed sewer treatment facility within the new Blind River Properties development on the right descending bank of the ARDC east of the Petite Amite River is planned for installation approximately 1.3 miles west of the Blind River. This new development would also receive sewer service from Wastewater Treatment of Louisiana, Inc.

Mail service is provided through the Maurepas Post Office northeast of the project area (which is why all of the residences and businesses have Maurepas addresses). Schools are readily available in Livingston Parish, which has benefitted from the movement of population to the east out of Baton Rouge.

4.2.15.9 Local Government Finance

Historic Conditions. Historically, government finances within the LCA ARDC study area were small proceeds directed towards Ascension and Livingston Parishes. Increased development, as well as increases in income levels, has led to increases in government finances.

Existing Conditions. Increasing population growth increased local government finances. There are no incorporated towns within the LCA ARDC study area and therefore no issues connected with local government finance. Head of Island and Coteau Bourgeois west of the LCA ARDC study area are not incorporated.

4.2.15.10 Tax Revenue and Property Values

Historic Conditions. The development of properties on the dredged material berms within and outside of the project area, along with increases in business, have resulted in increased property values and tax revenues for Ascension and Livingston Parishes.

Existing Conditions. Increasing population growth increases tax revenue and property values. The development of properties on both banks of the ARDC within and outside of the LCA ARDC study area has resulted in increased property values and tax revenues for Livingston Parish.

4.2.15.11 Community and Regional Growth

Historic Conditions. An increase in residential development on the dredged material berms has led to community and regional growth within the LCA ARDC study area. Berthelot's Campground (Figure 4.9) has experienced very little growth since its inception in the 1960s. Waterfront East and Three Rivers Island were only recently developed and therefore have experienced absolute growth if measured from the point of inception and nearly complete growth if measured from the expected point of completion. These developments and others on the ARDC have been important factors in the growth of the southern portion of Livingston Parish.

Existing Conditions. Increasing population is resulting in community and regional growth. The three communities within the LCA ARDC study area are Berthelot's Campground, Waterfront East, and Three Rivers Island. The Blind River Campsites should be considered a potential community because only one camp has been established. Berthelot's Campground has experienced very little growth since its inception in the 1960s. Waterfront East and Three Rivers Island were only recently developed and, therefore, have experienced absolute growth if measured from the point of inception and nearly complete growth if measured from the expected point of completion. Both of these communities are nearly fully developed in the sense that most of the lots in Waterfront East and Three Rivers Island have been sold and contain residences or campsites. These developments and others on the ARDC have been important factors in the growth of the southern portion of Livingston Parish.

4.2.15.12 Land Use Socioeconomics

Agriculture

Historic Conditions. Historically, a significant amount of agricultural development existed just beyond the LCA ARDC study area. No significant agriculture has existed within the LCA ARDC study area.

Existing Conditions. There is no agricultural or pasturage acreage in the project area.

Forestry

Historic Conditions. Timber was harvested extensively throughout the LCA ARDC study area prior to the 1940s (John McKenna, 1975 Louisiana State University Thesis, *The Role of Water Transportation in the Settlement of Bayou Manchac and the Amite River*).

Existing Conditions. A timber survey and appraisal was conducted in 1994 by professional forestry consultants for the 32,806 acres owned by Blind River Properties. The consultants found that there were no areas of cypress and tupelo in the swamps with trees of sufficient size and volume to be considered merchantable. Merchantable size timber (red oak, sweet gum, and ash) was found only on the ridges, including those in the LCA ARDC study area. However, marketability was considered doubtful because of inaccessibility. Little timber harvesting occurs within the LCA ARDC study area. However, submerged cypress logs are extracted from nearby bayous and lakes and processed by several local timber mills.

Public Lands

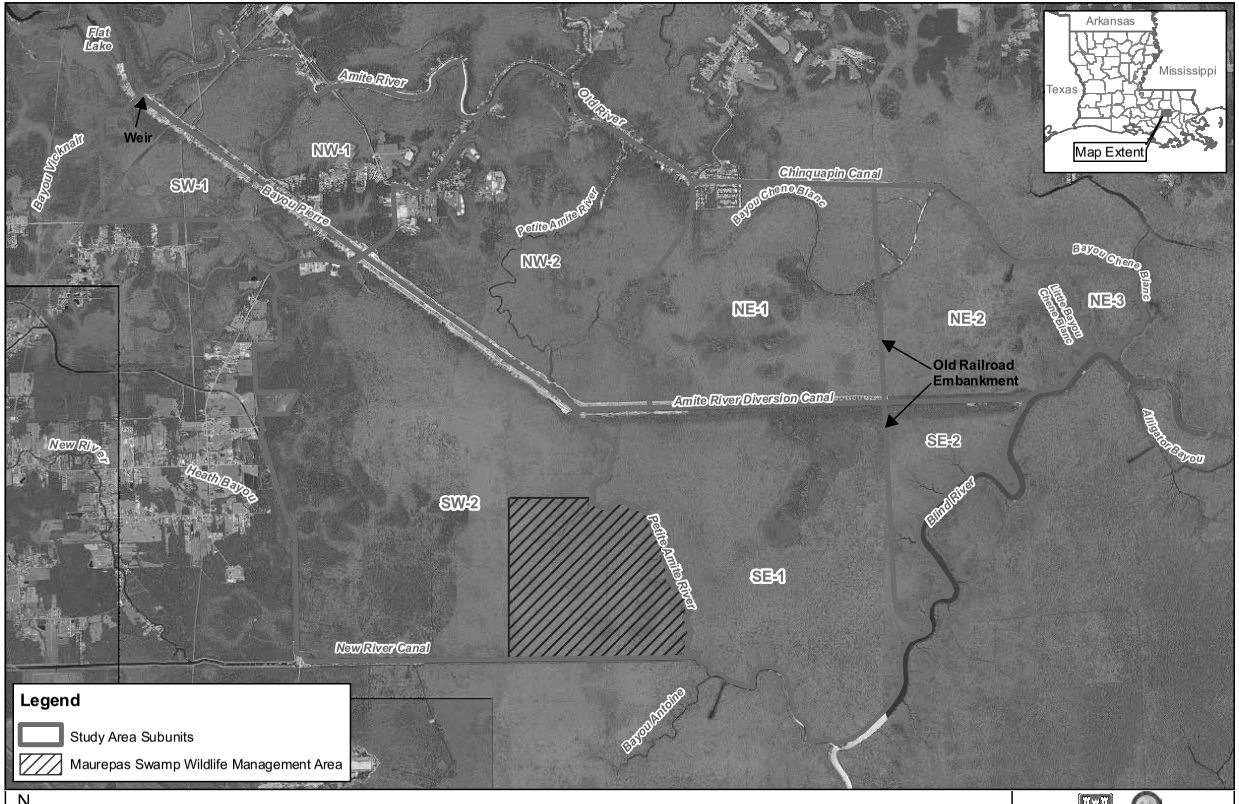
Historic Conditions. In 2001, the Maurepas Swamp Wildlife Management Area (WMA) was donated by the Richard King Mellon Foundation to the State of Louisiana (Figure 4.11). This management area consists of 1,742 acres within the LCA ARDC study area. No other public lands have existed within the LCA ARDC study area.

Existing Conditions. The LDWF administers the Maurepas Swamp WMA within the LCA ARDC study area. This WMA consists of 1,742 acres just north of New River Canal (Figure 4.11).

4.2.15.13 Navigation

Historic Conditions. The construction of the ARDC and the Chinquapin Canal in the late 1950s and early 1960s respectively, has led to increased recreational boat navigation.

Existing Conditions. There is minimal commercial navigation in the LCA ARDC study area. The streams and canals of the project area are used for recreational boating and fishing, particularly during the summer.



PUBLIC LANDS NEAR THE LCA-ARDC STUDY AREA

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure:	4.11
Date:	January 2010
Scale:	1:80,000
Source:	USDA/GEC
Map ID:	27850108-1506

4.2.15.14 Man-Made Resources

Oil, Gas, Utilities and Pipelines

Historic Conditions. The western Maurepas Swamp has undergone significant oil and gas exploration activity, particularly in the early to mid-20th century. However, most oil and gas exploration and production activities in the region have occurred southwest of the LCA ARDC study area.

Existing Conditions. Data from the LDNR Strategic Online Natural Resources Information System (SONRIS) (**http://sonris-www.dnr.state.la.us/www_root/sonris_portal_1.htm**) indicate that oil and gas production activities within the LCA ARDC study area have been relatively light and occurred primarily in the late-20th century (Figure 4.12). The oil and gas wells in the project area are dry holes, plugged and abandoned.

Flood Control and Hurricane Protection Levees

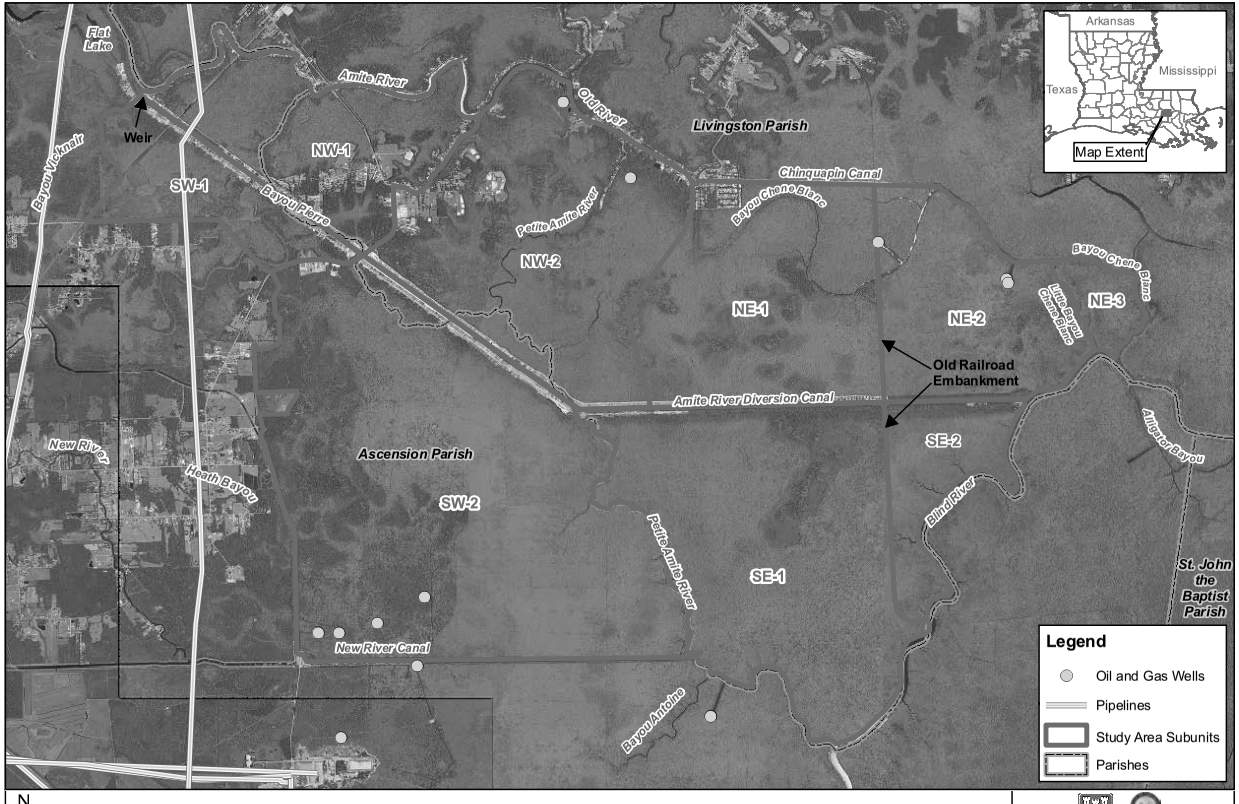
Historic Conditions. Hurricane protection levees have not been utilized within the LCA ARDC study area. Localized flood control has consisted of the construction of minor ditches for drainage. The construction of the Chinquapin Canal in the early 1960s and the ARDC in 1957 was initiated in an effort to provide flood control within the LCA ARDC study area.

Existing Conditions. The ARDC and the Chinquapin Canal were both constructed for flood control and drainage. These are the only flood control measures in the project area. The New River Canal southwest of the project area conveys water from the Marvin Breaux Pump Station at Gonzales and discharges into the Petite Amite River at the southwest boundary of the project area. There are no hurricane protection levees in the study area. Hurricane protection has been increased beyond the study area by West Lake Shore Pontchartrain Hurricane Protection Project

4.2.15.15 Natural Resources

Commercial Fisheries

Historic Conditions. Some small, localized commercial fishery operations have existed within the LCA ARDC study area, including operations harvesting catfish within the Blind River. Very little commercial fishery harvesting has taken place within the LCA ARDC study area.



OIL, GAS, AND UTILITIES NEAR THE LCA-ARDC STUDY AREA

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 4.12
Date: January 2010
Scale: 1:80,000
Source: USDA/GEC
Map ID: 27850108-1373

Existing Conditions. The LCA ARDC study area provides some habitat for gulf menhaden and striped mullet, but no commercial fishery for these species is present. There are little commercial fisheries in the LCA ARDC study area. A number of catfish are taken by commercial fishermen employing hoop nets on the Blind River and Petite Amite River. There is also a limited amount of crabbing on the same streams. There are no oyster leases located within the LCA ARDC study area.

4.2.16 Hazardous, Toxic, and Radioactive Wastes (HTRW)

The USACE is obligated under ER 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of the proposed action. ER 1165-2-132 identifies the USACE policy to avoid the use of project funds for HTRW removal and remediation activities. Costs for necessary special handling or remediation of wastes (e.g., those regulated by the RCRA), pollutants and other contaminants, which are not regulated under the CERCLA, would be treated as project costs if the requirement is the result of a validly promulgated Federal, state, or local regulation. HTRW investigations facilitate early identification and consideration of HTRW problems. The Civil Works Project Plan routinely includes a phased and documented review to provide for early identification of HTRW potential at project sites. ER 1165-2-132 requires that viable options to avoid HTRW problems be determined and a procedure for resolution of HTRW concerns be established.

A Phase I Environmental Site Assessment (ESA) of the LCA ARDC study area was conducted in accordance with USACE Regulation ER 1165-2-132, Water Resources Policies and Authorities for HTRW Guidance for Civil Works Projects, 26 June 1992 and the American Society for Testing and Materials (ASTM) Standard E 2247-08 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property in order to identify recognized environmental conditions (REC) located on, or in the vicinity of, the LCA ARDC study area. See Appendix M

The environmental conditions were evaluated for the LCA ARDC study area by:

- Reviewing Federal, state, and local environmental databases;
- Conducting historical research;
- Interviewing pertinent personnel; and
- Performing a site investigation.

Based on the review of Federal, state, and local environmental databases, historical research, interviews, and site investigations, the assessment identified two RECs that may have adversely impacted, or may potentially impact, environmental conditions in the LCA ARDC study area:

- Underground Storage Tanks (UST) at the former Chinquapin Grocery, and
- Aboveground Storage Tank (AST) at Val's Marina.

A limited HTRW survey was conducted for the LCA ARDC study area to REC sites or potential REC sites in connection with the LCA ARDC study area. This survey was performed using the USEPA's EnviroMapper program and the LDEQ Geographic Information Systems (GIS) website. Multisystem queries of the available USEPA and LDEQ databases were used to identify the potential REC sites located within or in the vicinity of the LCA ARDC study area. Potential REC sites located within or near the LCA ARDC study area are summarized in Table 4.11.

Table 4.11. Potential REC Sites Located Within or Near the LCA ARDC Study Area (USEPA, LDEQ, 2008)

Facility Name	Facility Address	Database
USEPA Databases		
Creative Cajun Cooking	14468 Bayou Terrace, St. Amant	NPDES
Island Car Wash	14989 Hwy. 16, French Settlement	NPDES
Island Car Wash	**18961 LA Hwy. 22, Maurepas**	**NPDES**
Mecca Inn Restaurant and Lounge	14365 Mecca Rd., French Settlement	NPDES
Swamp Pop Café	**18897 LA Hwy. 22, Maurepas**	**NPDES**
Island Car Wash	Unknown	NPDES
Val's Marina, LLC	21162 LA Hwy. 22, Maurepas	NPDES
Don Stout	**13027 Deer St., Maurepas**	**RCRAGN**
LDEQ Databases		
Best Stop Quick Mart #12	15250 Hwy. 16, French Settlement	RUST
Brian's Superette	**18886 LA Hwy. 22, Maurepas**	**RUST**
Fisherman's One Stop	45273 LA Hwy. 22, St. Amant	RUST
Thunder Bayou Marina	**11191 River Highlands Dr., St. Amant**	**RUST**
Weedy's Pitt Stop	**18985 LA Hwy. 22, Maurepas**	**RUST**

Note: Facilities located within LCA ARDC study area are denoted by **bold** font.
Information gathered during Phase I ESA within LCA ARDC study area (Appendix L).
Investigations were conducted within a one mile radius surrounding the LCA ARDC study area.

A review of various Federal and state databases (i.e., USEPA, Notice of Proposed License Action [NPLA], CERCLA, No Further Response Action Plan [NFRAP], RCRA Corrective Action Sites [CORRACTS], Resource Conservation and Recovery Act Generator [RCRAGN], RCRA TSD, National Pollution Discharge Elimination System [NPDES], and Toxic Release Inventory (TRI) databases; LDEQ Landfills Type I and II, RUST, and Motor Fuel UST Active 2005 databases) indicates that none of the potential REC sites listed in Table 4.11 would be likely to expose the public or construction workers to HTRW or to adversely affect the project.

5.0 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences of implementing alternative plans to reverse the trend of degradation in the western portion of the Maurepas Swamp. The following analysis compares the No-Action Alternative (future without project conditions) to the final array of alternatives over the 50-year period of analysis (2012 - 2062). The final array of alternatives includes Alternatives 33, 34, 35, 36, 37, 38 and 39 (see Section 2 for detailed descriptions). Alternative 33 was the Tentatively Selected Plan (TSP) and was later confirmed as the Recommended Plan. Alternative 39 is the National Ecosystem Restoration (NER) Plan.

A comparison of the direct, indirect, and cumulative impacts for alternatives to reverse the trend of degradation in the western portion of the Maurepas Swamp is presented herein. Direct impacts are effects caused by the proposed action that occur at the same time and place (Section 1508.8(a) of 40 CFR Parts 1500-1508). Indirect impacts are effects caused by the action that occur later in time or further removed in distance, but are still reasonably foreseeable (Section 1508.8(b) of 40 CFR Parts 1500-1508). Cumulative impacts are effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from actions that individually are minor, but collectively result in significant actions taking place over time (Section 1508.7 40 CFR Parts 1500-1508).

The cumulative impact analysis followed the 11-step process described in the Council of Environmental Quality 1997 report entitled *Considering Cumulative Effect under the National Environmental Policy Act*. Table 5.1 summarizes cumulative impacts for each of the alternatives in the final array of alternative plans across all important resources.

This environmental analysis evaluates and compares, from a qualitative and quantitative perspective, the alternatives carried over for detailed analysis. Impact analysis described in this section is based on a combination of scientific and engineering analyses, professional judgment, field investigations, and previously compiled information.

5.1 SOILS AND WATERBOTTOMS

5.1.1 Soils

5.1.1.1 No-Action Alternative

Direct. No direct impacts to soil resources would occur.

Indirect. Indirect impacts would include the continued erosion and land loss that would continue throughout the study area, eroding primarily Barbary, Fausse, and Maurepas soils. Most of the erosion would occur in the interfaces between open water with marsh and/or upland habitat. Soils would be indirectly impacted by habitat conversion from swamp to marsh and the eventual loss of existing soil resources converting to shallow open water.

Cumulative. Loss of soil resources from the study area would continue, in addition to the loss of soil resources throughout coastal Louisiana. The Louisiana Coastal Area (LCA) Near-term Ecosystem Restoration Plan (U.S. Army Corps of Engineers [USACE], 2004) estimated coastal Louisiana would continue to lose land at a rate of approximately 6,600 acres per year over the next 50 years. It is estimated that an additional net loss of 328,000 acres may occur by 2050, which represents nearly 10 percent of Louisiana's remaining coastal wetlands. However, these impacts to wetland soils within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (Figure 5.1 and Table 5.2). Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system, which would be additive with other swamp losses and degradation impacts to soils throughout the region and state. This acreage represents the total area, which is predicted to convert from freshwater swamp and marsh to open water over the 50-year period of analysis, as shown in Figure 2.2.

5.1.1.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to soil resources would result from construction activities associated with the removal of the existing dredged material berm along the Amite River Diversion Canal (ARDC), dredging of new conveyance channels, as well as the placement of dredged material to create Bottom Land Hardwood (BLH) "islands" along dredged conveyance channels. Implementation of Alternative 33 would remove approximately 2.6 acres of the existing ARDC dredged material berms. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as 5.0 acres of new BLH habitat "islands." Dredging of the conveyance channels would remove approximately 28.6 acres of soil from the swamp floor. All material dredged during construction of the conveyance channels would be placed along the channels to also create BLH habitat "islands," approximately 9.9 acres. The BLH "islands" would be located to allow sufficient sheet flow to be conveyed from the swamp. The excavation and placement of dredged materials would directly release sediments into the ARDC and adjacent swamp. Sediment introduction would temporarily increase total suspended and

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Soil and Waterbottoms-Soils	*US:* Institutional recognition of importance of soils via formation of Natural Resources Conservation Service (Soil Conservation Service) *LA:* Louisiana coastal land loss of over 1.22 million acres since 1956. *SA:* Loss of 1,600 acres in Amite/Blind River mapping unit between 1932 and 1990 (LCWCRTF and WCRA, 1999).	*US, LA, and SA:* Continued institutional recognition; continued loss of soil resources. Natural processes of parent material, climate, organisms, relief, and time factors in soil formation. *LA:* Continued land loss of over 25 square miles per year. *SA:* Continued land loss due to natural and human-induced causes. Barbary, Fausse, and Maurepas soils are primarily affected.	*US, LA, and SA:* Continued institutional recognition; continued loss of soil resources. *SA:* Shoreline erosion and land loss persist resulting in the loss of soil resources. Over 50-year period of analysis; projected conversion of 18,204 acres of swamp soils to fresh marsh and open water. Barbary, Fausse, and Maurepas soils would primarily be affected.	*US & LA:* Continued institutional recognition and programs for soil conservation to reduce soil losses. ALT 33 (Recommended Plan): This alternative would have positive effects on soil resources when combined with other Federal, state, local, and private restoration efforts. A net total of 1,602 acres of wetland soils would be hydrologically restored and nourished; 2.6 acres of soils along ARDC berms and 28.6 acres of existing swamp soils would be impacted by construction of conveyance channels, however these sediments would be used to construct 5.0 acres of "BLH islands". ALT 34: Cumulative impacts similar to ALT 33 (RECOMMENDED PLAN). A net total of 1,459 acres wetland soils would be hydrologically restored and nourished; 3.4 acres ARDC berm soils and 15.4 acres of existing swamp soils would be impacted and used to construct 2.7 acres of "BLH islands". ALT 35: Cumulative impacts similar to ALT 33. A net total of 820 acres wetland soils would be hydrologically restored and nourished; 2.4 acres ARDC berm soils and 10.9 acres of existing swamp soils would be impacted and used to construct 2.2 acres of "BLH islands". ALT 36: Cumulative impacts similar to ALT 33. A net total of 3,061 acres wetland soils would be hydrologically restored and nourished; 6.0 acres ARDC berm soils and 44.0 acres of existing swamp soils would be impacted and used to construct 7.8 acres of "BLH islands". ALT 37: Cumulative impacts similar to ALT 33. A net total of 2,279 acres wetland soils would be hydrologically restored and nourished; 5.8 acres ARDC berm soils and 26.3 acres of existing swamp soils would be impacted and used to construct 4.9 acres of "BLH islands". ALT 38: Cumulative impacts similar to ALT 33. A net total of 2,422 acres wetland soils would be hydrologically restored and nourished; 5.0 acres ARDC berm soils and 39.5 acres of existing swamp soils would be impacted and used to construct 7.2 acres of "BLH islands". ALT 39: Cumulative impacts similar to ALT 33. A net total of 3,881 acres wetland soils would be hydrologically restored and nourished; 8.4 acres ARDC berm soils and 54.9 acres of existing swamp soils would be impacted and used to construct 9.9 acres of "BLH islands".
Soils and Water bottoms-Water bottoms	*US, LA, & SA:* Water bottoms develop in response to natural and man-made conditions. *SA:* Construction of the ARDC and side-cast dredged material berms restricts hydrologic connectivity and impounds swamp habitat.	*US & LA:* Continuing land loss results in increasing acreage of shallow open water and water bottoms. *SA:* Increasing acreages of water bottoms due to conversion of swamp habitat to freshwater marsh and open water habitats.	*US & LA:* Increased acreage of shallow water bottoms in response to wetland loss. *SA:* Continued conversion of swamp to freshwater marsh and open water.	*US & LA:* Increased acreage of shallow water bottoms in response to wetland loss. ALT 33 (Recommended Plan): This alternative would have positive effects on water bottoms when combined with other Federal, state, local, and private restoration efforts. Reestablishing hydrologic connections would aid in restoring swamp habitat and would decrease acreage of water bottoms within the swamp; construction of conveyance channels would create 18.6 acres of water bottom habitats. ALT 34: Cumulative impacts would be similar to ALT 33 except would create 10.5 acres of water bottom habitats. ALT 35: Cumulative impacts would be similar to ALT 33 except would create 7.2 acres of water bottom habitats. ALT 36: Cumulative impacts would be similar to ALT 33 except would create 29.1 acres of water bottom habitats. ALT 37: Cumulative impacts would be similar to ALT 33 except would create 17.7 acres of water bottom habitats. ALT 38: Cumulative impacts would be similar to ALT 33 except would create 25.8 acres of water bottom habitats. ALT 39: Cumulative impacts would be similar to ALT 33 except would create 36.3 acres of water bottom habitats.
Hydrology–Flow and Water Levels	*US & LA:* Flows and water levels respond to natural conditions and man-made conditions. *SA:* Decreased flows into and out of the swamp due to construction of dredged material berms along ARDC.	*US & LA:* Increased flows and water levels with increased runoff due to increasing urbanization and wetland loss. Rate of RSLR increasing over historic conditions. *SA:* Decreased flows into and out of the swamp due to dredged material berms along ARDC. Increased runoff due to increased urbanization of the Pontchartrain Basin.	*US & LA:* Increased flows and water levels with increased urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. *SA:* Decreased flows into and out of the swamp due to dredged material berms along ARDC. Increased water levels due to coastal wetland loss, and increased runoff due to increased urbanization of the Pontchartrain Basin.	*US & LA:* Increased flows and water levels with increased urban runoff from increasing urbanization and increased wetland loss. Rate of RSLR increasing over historic conditions. ALT 33 (Recommended Plan): This alternative would have positive effects on water levels and flows when combined with other Federal, state, local, and private restoration efforts. Three cuts in the ARDC dredged material berm would reconnect the hydrology and increase flows into and out of 1,602 acres of swamp; water levels fluctuate in response to ARDC and sea level rises. ALT 34: Cumulative impacts would be similar to ALT 33 except one cut reconnect hydrology of 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except one cut reconnect hydrology of 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except four cuts reconnect hydrology of 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except two cuts reconnect hydrology of 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except four cuts reconnect hydrology of 2,422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except five cuts reconnect hydrology of 3,881 acres.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Hydrology–Sediment	*US:* Decreasing sedimentation due to reduction of erosion on land, reservoirs, and stream banks by stabilization. *LA & SA:* Sediment delivery by crevasses ended after Flood Control Act of 1928. *SA:* Decreased redistribution of sediments into and out of the swamp due to dredged material berms along ARDC. Amite River is primary source of sediments.	*US:* Decreasing sedimentation due to reduction of erosion on land, reservoirs, and stream banks by stabilization. *LA & SA:* Inflow of suspended sediments by Mississippi River limited by construction of levees. *SA:* Decreased redistribution of sediments into and out of the swamp due to dredged material berms along ARDC.	*US:* Continued decreasing sedimentation due to reduction of erosion. *LA:* Sediment supply would not offset coastal land loss. *SA:* Storms cause some redistribution of sediments to and from the swamp and surrounding water, but the ARDC dredged material berm would continue to block exchange and therefore sedimentation. The swamp would continue to deteriorate due to this impoundment and lack of sediment supply.	*US & LA:* Continued decreasing sedimentation due to reduction of erosion. ALT 33 (Recommended Plan): This alternative would have positive effects on hydrology sediments when combined with other Federal, state, local, and private restoration efforts. Reconnected hydrology increases potential for sediment inputs into 1,602 acres. ALT 34: Cumulative impacts would be similar to ALT 33 except increased potential for 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except increased potential for 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except increased potential for 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except increased potential for 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except increased potential for 2, 422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except increased potential for 3,881 acres.
Hydrology–Water Use and Supply	*US, LA, & SA:* Increasing surface water use and supply demands due to increasing human populations, agriculture and industry uses. *SA:* No significant surface water use or supply issues for humans.	*US, LA, & SA:* Continued increasing demands for surface water use and supply due to increasing human populations, agriculture and industry uses. *SA:* No significant surface water uses or supply issues for humans; conversion of swamp habitat to open water habitat reduces water purification function of forested wetlands.	*US, LA, & SA:* Continued increasing demands for surface water use and supply due to increasing human populations, agriculture and industry uses. *SA:* Continued conversion of swamp habitat to open water habitat reduces water purification function of wetlands indirectly impacting human uses.	*US & LA:* Continued increasing demands on surface water use and supply due to increasing human populations, agriculture and industry uses. ALT 33 (Recommended Plan): Continued increase in human water use and supply demands; reconnected hydrology improves water purification function over 1,602 acres swamp. ALT 34: Cumulative impacts would be similar to ALT 33 except improves purification function of 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except improves purification function of 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except improves purification function of 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except improves purification function of 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except improves purification function of 2,422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except improves purification function of 3,881 acres.
Hydrology–Groundwater	*US, LA, & SA:* Increasing demands for groundwater by increasing human populations, agriculture, and industry. *SA:* Groundwater is not an issue of concern; groundwater is primarily from the Chicot Equivalent aquifer.	*US, LA, & SA:* Decreased groundwater resources due to increasing demands by increasing human populations, agriculture, and industry. *SA:* Groundwater is not an issue of concern; groundwater is primarily from the Chicot Equivalent aquifer.	*US, LA, & SA:* Decreased groundwater resources due to increasing demands by increasing human populations, agriculture, and industry. *SA:* Groundwater is not an issue of concern; groundwater is primarily from the Chicot Equivalent aquifer.	*US & LA:* Decreased groundwater resources due to increasing demands by increasing human populations, agriculture, and industry. ALT 33 (Recommended Plan): This alternative would have little to no impact on groundwater, which is primarily taken from the Chicot Equivalent aquifer. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Water Quality	*US & LA, SA:* Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. *SA:* Human developments along the ARDC, Amite and Blind Rivers and on ridges begin to adversely impact water quality. The ARDC northeast of Sorrento is listed as impaired for mercury.	*US, LA, & SA:* Continued institutional recognition. Increasing human populations, agriculture and industrialization result in increased potential for water quality problems. *SA:* Human developments result in wastewater and polluted runoff from nearby urban areas; continued conversion of swamp habitat to marsh and open water reduces natural filtration of water.	*US, LA & SA:* Continued institutional recognition. Increasing human populations and industrialization result in increased potential for water quality problems. *SA:* Conversion of 18,204 acres of swamp to marsh and open water reduces natural filtration of water by swamp vegetation; continued discharge of untreated stormwater runoff from nearby populated areas.	*US, LA & SA:* Continued institutional recognition. Increasing human populations and industrialization result in increased potential for water quality problems. ALT 33 (Recommended Plan): This alternative would have positive effects on water quality when combined with other Federal, state, local, and private restoration efforts. Temporary negative impacts (e.g., increased turbidity, decreased dissolved oxygen (DO)) during construction. Water quality improves over 1,602 acres of swamp habitat due to increased hydrologic connectivity as well as absorption and filtering of untreated stormwater runoff from nearby populated areas. ALT 34: Cumulative impacts would be similar to ALT 33 except 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except 2,422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except 3,881 acres.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Water Quality – Salinity	*US & LA:* Increase in salinity levels inland due to salt water intrusion, due in part to wetlands loss. *SA:* Construction of ARDC results in impounding storm driven higher salinity waters within SA and causes it to absorb into the substrate resulting in degradation of freshwater swamp ecosystem.	*US & LA:* Increase in salinity levels inland due to salt water intrusion from wetlands loss and reduction in freshwater inflow. *SA:* Continued impounding of higher salinity waters causing it to absorb into the substrate resulting in degradation of freshwater swamp ecosystem.	*US & LA:* Increase in salinity levels inland due to salt water intrusion from wetlands loss and reductions in freshwater inflow. Salinities may also increase due to projected relative sea level rise. *SA:* Continued impoundment and lack of hydrologic connections result in longer residence time of higher salinity water resulting in absorption of salinity into swamp soils continuing the degradation of freshwater swamp and BLH vegetation.	*US & LA:* Increase in salinity levels inland due to salt water intrusion from wetlands loss and reductions in freshwater inflow. Salinities may also increase due to projected RSLR. ALT 33 (Recommended Plan): This alternative would reduce salinity when combined with other Federal, state, local, and private restoration efforts. Restored hydrologic connectivity of 1,602 acres would reduce impoundment of higher salinity waters. ALT 34: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 2,422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except restored hydrologic connectivity of 3,881 acres.
Air Quality	*US, LA, & SA:* Institutional recognition via Clean Air Act of 1963. LA & SA: Institutional recognition via Louisiana Environmental Quality Act of 1983. Formation of USEPA and LDEQ. *SA:* not an issue.	*US, LA, & SA:* Continued institutional recognition; deterioration of air quality in the region due to increases in human populations and industry. *LA, & SA:* These impacts are coupled with the loss of Louisiana coastal wetland vegetation that is no longer available to remove gaseous pollutants. *SA:* Human development along the ARDC, Amite and Blind Rivers and on ridges. In nonattainment area for ozone.	*US, LA, & SA:* Continued institutional recognition; deterioration of air quality due to continued population growth and increased industrialization. *LA, & SA:* These impacts would be coupled with the continued loss of Louisiana coastal wetland vegetation that would no longer be available to remove gaseous pollutants. *SA:* Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat over 50-year period of analysis reduces function of swamp vegetation to act as natural filter for air pollutants.	*US & LA:* Continued institutional recognition; continued deterioration of air quality due to continued population growth and increased industrialization. ALT 33 (Recommended Plan): This alternative would have positive effects on air quality when combined with other Federal, state, local, and private restoration efforts. Restoration of 1,602 acres freshwater swamp habitat may act as natural filters for air pollutants. ALT 34: Cumulative impacts would be similar to ALT 33 except restoration of 1,459 acres. ALT 35: Cumulative impacts would be similar to ALT 33 except restoration of 820 acres. ALT 36: Cumulative impacts would be similar to ALT 33 except restoration of 3,061 acres. ALT 37: Cumulative impacts would be similar to ALT 33 except restoration of 2,279 acres. ALT 38: Cumulative impacts would be similar to ALT 33 except restoration of 2,422 acres. ALT 39: Cumulative impacts would be similar to ALT 33 except restoration of 3,881 acres.
Noise	*US, LA, & SA:* Institutional recognition via Noise Control Act of 1972. *SA:* Noise pollution sources are development along the ARDC, Amite, and Blind Rivers, on ridges, and boat traffic on ARDC, Amite and Blind Rivers, Noise is not yet an issue.	*US, LA, and SA:* Continued institutional recognition; continued human population growth and development cause some noise pollution. *SA:* Ambient noise from boats and airboats on ARDC, Amite and Blind Rivers, and other human activities may cause some minimal and temporary disturbances.	*US, LA, and SA:* Continued institutional recognition; continued human population growth and development would cause some noise pollution. *SA:* Ambient noise from boats and airboats on ARDC, Amite and Blind Rivers, and other human activities continue to cause some minimal and temporary disturbances.	*US & LA:* Continued institutional recognition; continued human population growth and development would cause some noise pollution. ALT 33 (Recommended Plan): Short term, localized and temporary increased noise associated with construction activities. Long term, impacts similar to No-Action Alternative. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Vegetation - Riparian Vegetation	*US, LA, & SA:* Natural processes form coastal vegetation resources. Riparian vegetation is located at the interface of land and a flowing water body. *SA:* Construction of ARDC results in creation of riparian habitat along dredged material berms along the ARDC as well as the banks of other water bodies.	*US, LA, & SA:* Deterioration and loss of wetlands nationwide and statewide. *SA:* Riparian habitat is primarily limited to the dredged material berms along the ARDC and the banks of other water bodies. Saltwater intrusion from storm events has additionally stressed the swamp habitat along the Blind River.	*US, LA, and SA:* Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. *SA:* Riparian vegetation along ARDC berms likely unchanged over 50-year period of analysis.	*US & LA:* Continued institutional recognition and programs for soil conservation to reduce soil losses. ALT 33 (Recommended Plan): This alternative would have positive effects on riparian vegetation when combined with other Federal, state, local, and private restoration efforts. There would be creation of riparian habitat along conveyance channels. Riparian vegetation on dredged material berms would be impacted by construction. ALTS 34-39: Cumulative impacts similar to ALT 33.

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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Vegetation-Wetland Vegetation	*US, LA, & SA:* Natural processes form coastal wetland vegetation resources. *SA:* Degradation of approximately 26,493 acres of primarily bald cypress-tupelo swamp habitat, leaving approximately 18,204 acres in the Amite/Blind River mapping unit.	*US, LA, & SA:* Deterioration and loss of wetlands nationwide and statewide due to natural and human-induced processes. *SA:* About 18,204 acres of primarily bald cypress-tupelo swamp habitat are presently impounded to differing levels. Existing swamp habitats converting to marsh and shallow open water habitats. Saltwater intrusion from storm events has additionally stressed the swamp habitat along the Blind River.	*US, LA, and SA:* Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. *SA:* Conversion of 18,204 acres of existing swamp to fresh marsh and open water over 50-year period of analysis.	*US & LA:* Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. ALT 33 (Recommended Plan): This alternative would have positive effects on wetland vegetation resources when combined with other Federal, state, local, and private restoration efforts. A net total of 1,602 acres of primarily bald cypress-tupelo swamp habitat would be restored and nourished. Vegetation reduces shoreline erosion and potentially helps future healthy productive swamps to accrete sediments at rates near or equal to local sea level rise, such that localized relative subsidence may also be reduced. Additionally, the enhanced wetland acreage would provide some protection to ecosystems inland from the study area, potentially reducing loss rates. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres swamp habitat restored and nourished. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres swamp habitat restored and nourished. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres swamp habitat restored and nourished. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres swamp habitat restored and nourished. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres swamp habitat restored and nourished. ALT 39: Cumulative impacts similar to ALT 33 except 3,881acres swamp habitat restored and nourished.
Vegetation-Upland Vegetation	*US, LA, & SA:* Natural processes form coastal vegetation resources. *SA:* Upland habitat is primarily limited to the dredged material berms along the ARDC.	*US, LA, & SA:* Deterioration and loss of uplands nationwide and statewide. *SA:* Upland habitat is primarily limited to the dredged material berms along the ARDC and the banks of other water bodies in the area.	*US, LA, & SA:* Continued deterioration and loss of vegetated upland habitat acreage due to natural and human-induced processes. *SA:* The upland vegetation would convert to unstable freshwater marsh, which in turn would convert to open water.	*US & LA:* Continued deterioration and loss of vegetated wetland habitat due to natural and human-induced processes. ALT 33 (Recommended Plan): This alternative would have little effect on upland vegetation when combined with other Federal, state, local, and private restoration efforts. Upland vegetation located on dredged material berms along the ARDC would be impacted by construction. ALTS 34-39: Cumulative impacts similar to ALT 33.
Vegetation-Submerged Aquatic Vegetation (SAV)	*US, LA, & SA:* Natural and man-influenced processes form SAVs. *SA:* SAVs limited to shallow areas with flow that is high enough to keep the area clear of floating species within the ARDC and other water bodies.	*US, LA, & SA:* Deterioration and loss of wetlands nationwide and statewide. *SA:* SAVs limited to shallow areas with flow that is high enough to keep the area clear of floating species within the ARDC and other water bodies.	*US, LA, and SA:* Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. *SA:* Conversion of 18,204 acres swamp vegetation to fresh marsh and open water habitat with little to no flow over 50-year period of analysis. Associated poor water quality likely not conducive to growth of SAVs.	*US & LA:* Continued deterioration and loss of vegetated wetland habitat due to natural and human-induced processes. ALT 33 (Recommended Plan): This alternative would have positive effects on SAVs when combined with other Federal, state, local, and private restoration efforts due to the creation of more shallow, flowing habitat in the swamp interior. Reconnecting hydrology to 1,602 acres of swamp makes conditions conducive for SAV. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres reconnected. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres reconnected. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres reconnected. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres reconnected. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres reconnected. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres reconnected.
Vegetation-Invasive Species	*US, LA, & SA:* Natural processes form coastal vegetation resources. Invasive species have been intentionally and unintentionally released and are outcompeting native vegetation species and spreading throughout many habitat types.	*US, LA, & SA:* Continued spread of invasive species throughout many habitat types. *SA:* The spread of invasive species continues to alter ecosystem function by decreasing native plant communities.	*US, LA, and SA:* Continued spread of invasive species throughout many different habitats. Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. *SA:* Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat. Invasive species would continue to spread throughout.	*US & LA:* Continued spread of invasive species throughout many different habitats. Continued deterioration and loss of vegetated wetland habitat acreage due to natural and human-induced processes. ALT 33 (Recommended Plan): This alternative would increase invasive vegetation spread when combined with other Federal, state, local, and private restoration efforts due to the habitat disturbance from construction efforts. Reconnecting hydrology to 1,602 acres of swamp makes conditions conducive for invasive species to spread further. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres reconnected. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres reconnected. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres reconnected. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres reconnected. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres reconnected. ALT 39: Cumulative impacts similar to ALT 33 except 3, 881 acres reconnected.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Wildlife Resources	*US, LA, & SA:* Wetland dependent wildlife populations respond primarily to natural population-regulating mechanisms. *SA:* The bald eagle was removed from the endangered species list in 2007, but is currently undergoing five years of monitoring to confirm the revised status. The Southeast United States Regional Waterbird Conservation Plan was completed in 2006.	*US, LA, & SA:* Continued nationwide degradation and loss of wetlands leads to decline of wetland-dependent wildlife populations. *SA:* Continued swamp degradation and conversion to marsh and open water leads to increased competition between local wetland-dependent wildlife populations, displacement to other more suitable swamp wetland areas, and localized decline in wetland-dependent wildlife population. Bald eagle populations in the area are steady. A bald eagle nesting site is located within the study area. Habitat for wading birds in the area are declining due to swamp degradation	*US, LA, and SA:* Nationwide degradation and loss of swamp habitat continues to adversely impact wetland-dependent wildlife populations. *SA:* Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat resulting in continued decline in quality of and availability of swamp wildlife habitat. Conversion of swamp to open water will adversely affect populations of bald eagle and colonial nesting wading birds due to decreased nesting habitat and decreased food availability.	*US & LA:* Continued nationwide loss of vegetated wetlands continues to adversely impact wetland-dependent wildlife populations. ALT 33 (Recommended Plan): This alternative would have positive effects on wildlife resources when combined with other Federal, state, local, and private restoration efforts. Creation and nourishment of a net total of 1,602 acres of wildlife habitats. Migratory neo-tropical songbirds and waterfowl could increase as important migratory habitat is created and nourished. Although unlikely to impact wildlife populations on a continental scale, local populations of game animals, furbearers, reptiles, amphibians, and invasive species (especially nutria) would benefit from the cumulative effects of creating and nourishing important and essential transitional wetlands. Local populations of the bald eagle and colonial nesting wading birds would benefit from the cumulative effects of creating and nourishing wetlands. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres swamp habitat created and nourished. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres swamp habitat created and nourished. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres swamp habitat created and nourished. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres swamp habitat created and nourished. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres swamp habitat created and nourished. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres swamp habitat created and nourished.
Aquatic Resources - Plankton	*US & LA:* Institutionally recognized by the National Environmental Policy Act of 1969, the Coastal Zone Management Act, and the Estuary Protection Act. Plankton populations respond to natural conditions. *SA:* Construction of the ARDC resulted in dredged material berms which limits exchange of organisms and water between the swamp and the ARDC.	*US:* Continued institutional recognition. Populations respond to natural and human-induced perturbations. *LA:* Populations in LA are shifting towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. *SA:* Plankton population changes associated with conversion of swamp habitat to freshwater marsh and open water.	*US:* Continued institutional recognition. Populations continue to respond to natural and human-induced perturbations. *LA:* Populations in LA are shifting towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues . *LA & SA:* Conversion of swamp to fresh marsh and open water may shift populations, but there are no direct adverse impacts.	*US & LA:* Continued institutional recognition. Continued nationwide loss of vegetated wetlands continues to adversely impact wetland-dependent wildlife populations. ALT 33 (Recommended Plan): This alternative would have positive effects on plankton resources when combined with other Federal, state, local, and private restoration efforts. The creation of conveyance channels in concert with wetland creation and nourishment would result in greater productivity of plankton organisms due to the export of dissolved organic compounds. ALTS 34-39: Cumulative impacts similar to ALT 33.
Aquatic Resources-Benthic	*US, LA, & SA:* Benthic populations respond to natural and to human induced conditions. *SA:* Construction of the ARDC resulted in dredged material berms which limits exchange of benthic organisms and water between the swamp and the ARDC.	*US & LA:* Increased acreage of shallow water bottoms in response to wetland loss. Benthic populations respond to natural and human-induced perturbations with shift towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. *SA:* Benthic population changes associated with conversion of swamp habitat to freshwater marsh and open water.	*US & LA:* Increased acreage of shallow water bottoms in response to wetland loss. Benthic populations respond to natural and human-induced perturbations with shift towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. *SA:* Conversion of swamp to freshwater marsh and open water may shift benthic populations. The amount of habitat available for use by benthic species assemblages that typically utilize swamp or marsh edge habitats would decrease. The availability of nutrients and detritus from the decomposing swamp vegetation would initially increase, and then decrease.	*US & LA:* Increased acreage of shallow water bottoms in response to wetland loss. Benthic populations respond to natural and human-induced perturbations with shift towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. ALT 33 (Recommended Plan): This alternative would have positive effects on benthic resources when combined with other Federal, state, local, and private restoration efforts. Wetland restoration, nourishment, and reconnection of hydrology of 1,602 acres would result in greater resources for benthic organisms due to the export of dissolved organic compounds and detritus from the wetlands. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres swamp habitat restored. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres swamp habitat restored. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres swamp habitat restored. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres swamp habitat restored ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres swamp habitat restored. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres swamp habitat restored.
Fishery Resources	*US, LA, & SA:* Reduction in fisheries habitat, increased catches, gear improvement, catch regulations, Magnuson-Stevens Fishery Conservation and Management Act and amendments, Formation of NMFS and LDWF. About 90% of the world's seafood resources have been depleted in the past century; 38% of the depleted species have declined by more than 90%; 7% of the species of fish studied by researchers have become extinct (Worm *et al.*, 2006). *SA:* Construction of the ARDC and dredged material berms prevent exchange of organisms and water between the swamp and the ARDC.	*US, LA, & SA:* Continued institutional recognition, catch regulations, habitat loss decreased somewhat by coastal restoration efforts, and continued net habitat loss. *LA & SA:* Fishery populations in Louisiana are shifting towards more marine and higher salinity tolerant species as land loss and saltwater intrusion into interior regions continues. *SA:* Fishery population changes associated with conversion of swamp habitat to freshwater marsh and open water habitat and as water quality declines.	*US, LA, & SA:* Continued institutional recognition and catch regulations. Continued loss of fishery resources unless intensified efforts to protect them locally, statewide, and nationally. *LA & SA:* Populations in Louisiana would likely continue to shift towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. *SA:* Conversion of 18,204 acres of swamp vegetation to fresh marsh and open water habitat increases availability of open water habitat for fish and aquatic organisms. However, ARDC berms limit aquatic organism access; water quality declines make environment suitable only for those aquatic organisms tolerant of low DO conditions.	*US & LA:* Continued loss of fishery resources unless intensified efforts to protect them, locally, statewide, and nationally. ALT 33 (Recommended Plan): This alternative would have positive effects on fishery resources when combined with other Federal, state, local, and private restoration efforts. This alternative would restore a net total of 1,602 acres of bald cypress-tupelo swamp habitat. Swamp restoration and reconnected hydrology would result in greater resources for aquatic and fishery resources due to the export of dissolved organic compounds and detritus from wetlands. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres reconnected and restored. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres reconnected and restored. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres reconnected and restored. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres reconnected and restored. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres reconnected and restored. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres reconnected and restored.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Essential Fish Habitat (EFH)	*US and LA:* General decrease in quality of EFH beginning in the mid-1990s. Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended. *SA:* No EFH present.	*US and LA:* Continued institutional recognition; continued wetland loss and decline in quality of EFH. *SA:* No EFH present.	*US and LA:* Continued institutional recognition; continued wetland loss and decline in quality of EFH. *SA:* Continues to be no EFH present.	*US and LA:* Continued institutional recognition; continued wetland loss and decline in quality of EFH. ALT 33 (Recommended Plan): This alternative would have no effect on EFH. EFH not likely to develop. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Threatened and Endangered Species	*US, LA & SA:* Institutional recognition of importance of wetlands decline in listed species via the Endangered Species Act (ESA). Decrease in some animal and plant populations and their critical habitat including loss of wetlands.	*US, LA, & SA:* Continued institutional recognition of decline in listed species; continued loss of wetlands that are critical habitat to many listed species. *SA:* Degradation and loss of important fish and wildlife habitats for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements.	*US, LA, & SA:* Continued institutional recognition of decline in listed species; continued loss of wetlands. *SA:* Conversion of 18,204 acres of swamp habitat to fragmented and degraded fresh marsh and open water habitats; any listed species that may be presently utilizing the habitats would likely not be impacted.	*US and LA:* Continued institutional recognition of decline in listed species; continued loss of wetlands. ALT 33 (Recommended Plan): This alternative would have positive effects on threatened and endangered resources when combined with other Federal, state, local, and private restoration efforts. This alternative would restore a net total of 1,602 acres of swamp habitat that would be available for use by listed and other species. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres of habitat restored. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres of habitat restored. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres of habitat restored. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres of habitat restored. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres of habitat restored. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres of habitat restored.
Cultural and Historic Resources	*US, LA, & SA:* Institutional recognition via the National Historic Preservation Act (and others). Historic and cultural resources subjected to natural processes and man-made actions.	*US, LA, & SA:* Continued institutional recognition. Human activities as well as natural processes can potentially destroy historic and natural resources. The loss of land threatens the existence and integrity of these resources.	*US, LA, & SA:* Continued institutional recognition. Potential loss of resources due to natural and human causes. *SA:* The loss of land within the SA threatens the existence and integrity of these resources.	*US & LA:* Potential loss of resources due to natural and human causes. ALT 33 (Recommended Plan): All types of stabilization would prevent further land loss and erosion. This alternative would benefit cultural and historical resources in the long term by slowing or stopping land loss and erosion that threatens their existence. No archaeological sites were located at the proposed cuts, however one modern *Rangia cuneata* scatter was observed near the easternmost cut. The old railroad grade and the ARDC are recommended as not eligible for NHRP listing. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Aesthetics	*US, LA, & SA:* Technical recognition via 1988 USACE Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic Rivers Act, Scenic Byways and others. *LA & SA:* Aesthetic resources negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike. Blind River is a designated Scenic River.	*US, LA, & SA:* Continued institutional recognition. Visual resources have been destroyed, enhanced, or preserved by human activities and natural processes. *LA & SA:* Continued wetland loss may have an adverse effect on the visual complexity of the bayous and swamps.	*US, LA, & SA:* Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. *SA:* Erosion and land loss could result in the loss of vegetation that may provide a visually complex environment and desirable views and reduce opportunities for viewing wildlife.	*US & LA:* Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. ALT 33 (Recommended Plan): This alternative would have positive effects on aesthetics when combined with other Federal, state, local, and private restoration efforts. Maintaining visually appealing resources systems would support tourism on Louisiana's Scenic Byways and remote areas of visual interest. Restoration features would provide a more contiguous swamp, which would increase and protect desirable viewscapes. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Recreational	*US, LA, & SA:* Recreational resources not an issue. Institutional recognition via Federal Water Project Recreation Act, Land and Water Conservation Act, and National Wildlife Refuge System Acts. *SA:* Recreation activities in SA centered on natural resources. A portion of Maurepas Swamp WMA is present.	*US & LA:* Continued institutional recognition. Increased recreational activities impact national and state wetlands. *SA:* Recreation activities centered on natural resources. Continued conversion of marsh and swamp to open water resulting in decreasing recreational opportunities.	*US, LA, & SA:* Continued institutional recognition. Potential loss of recreational resource base due to continued swamp and freshwater marsh degradation and loss.	*US & LA:* Continued loss of recreational resource base due to continuing coastal and wetland degradation and loss. ALT 33 (Recommended Plan): This alternative would have positive effects on recreational resources when combined with other Federal, state, local, and private restoration efforts. It would support and sustain a greater number of wetland-dependent recreational activities, provide for a more stable localized recreational economy, and possibly increase local recreation-related employment and income. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Population and Housing	*US:* Population increasing in some areas, decreasing in other areas. *LA:* Hurricanes Katrina and Rita adversely affected populations throughout the state. *SA:* Development along the ARDC, Amite and Blind Rivers and on ridges. Populations within Ascension and Livingston Parishes increasing.	*US:* Increasing population (7.2%) from 2000-2007; with over 300 million people. *LA:* Slight decrease (-3.9%) in population from 2000-2007. *SA:* Development along the ARDC, Amite and Blind Rivers and on ridges. Populations within Ascension and Livingston Parishes have been increasing.	*US & LA:* Increasing populations worldwide. *SA:* There may be further construction and an increase in the population. Populations within Ascension and Livingston Parishes projected to increase further. Study area populations would be adversely impacted by continued habitat degradation and conversion.	*US & LA:* Increasing populations worldwide. Populations within Ascension and Livingston Parishes are projected to increase further. ALT 33 (Recommended Plan): This alternative would have no cumulative impacts on populations. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Employment and Income	*US:* Increased habitation, employment and tourism. *LA:* Slight increase in employment in Louisiana. Hurricanes Katrina and Rita had an adverse effect on employment and personal income. Rebuilding efforts provide some new job opportunities. *SA:* Development along the ARDC, Amite and Blind Rivers and on ridges. Total employment in Ascension and Livingston Parishes increasing.	*US & LA:* Increasing population growth and employment and personal income opportunities. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. *SA:* Development along the ARDC, Amite and Blind Rivers and on ridges. Employment and income resources are primarily retail, eating and drinking establishments. Total employment in Ascension and Livingston Parishes increasing.	*US & LA:* Increasing population growth and employment and personal income opportunities. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. *SA:* Development along the ARDC, Amite and Blind Rivers and on ridges. Total employment in Ascension and Livingston Parishes expected to increase.	*US & LA:* Increasing human populations lead to competition for employment and income. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. ALT 33 (Recommended Plan): This alternative would have positive effects on employment and income when combined with other Federal, state, local, and private restoration efforts. Cumulative impacts of the proposed action are related to the increased stability of the wetland resources throughout the region. Local wetland-dependent jobs, such as recreation and commercial fisheries, would likely be positively impacted. ALTS 34-39: Cumulative impacts would be similar to ALT 33.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Socioeconomic and Human Resources– Community Cohesion	*US, LA, & SA:* Community cohesion is affected by infrastructure development and community development. *LA:* Hurricanes Katrina and Rita adversely affected community cohesion in southern portions of the state. *SA:* The SA is populated along the ARDC, Amite and Blind Rivers, and on ridges.	*US, LA, & SA:* Community cohesion is affected by infrastructure development and community development. *LA:* Hurricanes Katrina and Rita adversely affected community cohesion in southern portions of the state. *SA:* The SA is populated along the ARDC, Amite and Blind Rivers, and on ridges.	*US, LA, & SA:* Community cohesion would continue to be affected by infrastructure development and community development. *SA:* Several of the current subdivisions would expand. A proposed bridge over the ARDC would increase community cohesion.	*US & LA:* Increasing populations worldwide. Increasing opportunity for infrastructure development and community cohesion development. ALT 33 (Recommended Plan): There would be no cumulative impacts on community cohesion. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Environmental Justice	*US:* Institutional recognition via Executive Order 12898. *LA:* Hurricanes Katrina and Rita adversely affected Environmental Justice resources in the state. *SA:* Population in the vicinity of Head of Island has 30-40% minority composition; poverty levels low within study area.	*US & LA:* Continued institutional recognition; increasing Environmental Justice resources as a result of increase in population and decrease in economic output from 2000-2009. *SA:* Environmental Justice resources within study area appear stable.	*US & LA:* Continued institutional recognition; potential increase in Environmental Justice resources as a result of continued economic recession. *SA:* There may be further construction and an increase in the population. Environmental Justice resources may increase; these resources would likely remain unchanged.	*US & LA:* Increasing populations worldwide. Increasing opportunity for the development of minority communities and the expansion of low-income populations worldwide. ALT 33 (Recommended Plan): There would be no cumulative impacts on environmental justice. There is no opportunity for the development of minority communities or the expansion of low-income populations as the areas impacted by this alternative are not populated. Environmental justice issues are unlikely to occur when combined with other Federal, state, local, and private restoration efforts. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Infrastructure	*US & LA:* Increasing population growth and supporting infrastructure in the form of roads, bridges, pipelines, homes, businesses, and decreases in coastal and other wetlands. *LA & SA:* Extensive damages to infrastructure due to Hurricanes Katrina and Rita which is still being repaired. State and local roads, railroad grade, overhead distribution lines, and underground telephone lines traverse the study area.	*US:* Increasing population growth and supporting infrastructure contributes to degradation and loss of coastal and other wetlands, which contributes to increased maintenance costs of infrastructure. *LA & SA:* State and local roads, relict railroad grade, overhead distribution lines, and underground telephone lines traverse the study area.	*US & LA:* Continued population growth and supporting infrastructure contributes to degradation and loss of coastal and other wetlands. Degradation and loss of wetlands would contribute to increased maintenance costs of infrastructure. *SA:* Wetland land loss potentially threatens infrastructure passing through area and would result in increased maintenance. Several of the current subdivisions would expand, creating additional roads, bridges, and associated utilities.	*US & LA:* Continued population growth and supporting infrastructure contributes to degradation and loss of coastal and other wetlands. Degradation and loss of wetlands contribute to increased maintenance costs of infrastructure. ALT 33 (Recommended Plan): This alternative would have positive effects on infrastructure when combined with other Federal, state, local, and private restoration efforts. There would be a reduced level of infrastructure damages and relocations compared to the No-Action Alternative. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Business and Industry	*US & LA:* Increasing population growth and supporting infrastructure in the form of roads, bridges, pipelines, homes, and businesses. *LA & SA:* Extensive damages to businesses and industry due to Hurricanes Katrina and Rita which is still being repaired. *SA:* Businesses are generally retail stores and restaurants.	*US & LA:* Increasing population growth and supporting businesses and industry development contributes to degradation and loss of coastal and other wetlands. *SA:* Businesses are generally retail stores and restaurants.	*US & LA:* Continued population growth and supporting business and industry development contributes to degradation and loss of coastal and other wetlands. Degradation and loss of wetlands would contribute to potential losses of businesses. *SA:* Wetland land loss would potentially threaten businesses in the study area.	*US & LA:* Continued population growth and supporting business and industry development contributes to degradation and loss of coastal and other wetlands, which contributes to potential loss of businesses. ALT 33 (Recommended Plan): This alternative would have little effects on business and industry when combined with other Federal, state, local, and private restoration efforts. The study area does not appear to provide many opportunities for future business growth. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Traffic and Transportation	*US & LA:* Increasing population growth increases traffic and transportation issues. *SA:* State and local roads traverse the study area. Traffic is generally confined to residents and recreational visitors.	*US & LA:* Increasing population growth increases traffic and transportation issues. *SA:* State and local roads traverse the study area. Traffic is generally confined to residents and recreational visitors.	*US & LA:* Continued population growth increases traffic and transportation issues *SA:* Wetland land loss potentially threatens roads passing through area and results in increased maintenance. Several of the current subdivisions would expand, creating additional roads, bridges, and traffic.	*US & LA:* Continued population growth increases traffic and transportation issues. ALT 33 (Recommended Plan): This alternative would have little effect on traffic and transportation when combined with other Federal, state, local, and private restomtion efforts. There would be a reduced level of road damages and relocations compared to the No-Action Alternative. ALTS 34-39: Cumulative impacts would be similar to ALT 33.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Socioeconomic and Human Resources– Public Facilities and Services	*US & LA:* Increasing population growth increases public facilities and services issues. *SA:* Public facilities and services generally serve residents and recreational visitors.	*US & LA:* Increasing population growth increases public facilities and services issues. *SA:* Public facilities and services generally serve residents and recreational visitors.	*US & LA:* Increasing population growth increases public facilities and services issues. *SA:* Wetland land loss potentially threatens public facilities and services and increases maintenance. Several of the current subdivisions would expand, creating additional needs for public facilities and services.	*US & LA:* Continued population growth increases public facilities and services issues. ALT 33 (Recommended Plan): This alternative would have little effect on public facilities and services when combined with other Federal, state, local, and private restoration efforts. There would be a reduced level of public facilities and services damages and relocations compared to the No-Action Alternative. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Local Government Finances	*US & LA & SA:* Increasing population growth increased local government finances.	*US & LA & SA:* Increasing population growth increases local government finances.	*US & LA:* Increasing population growth would increase local government finances. *SA:* There is no potential for new town development, and none would be developed in the future. Expansion of the current subdivisions would increase the tax base, thus increasing local government finances.	*US & LA:* Continued population growth increases local government finances. ALT 33 (Recommended Plan): This alternative would have little effect on local government finances when combined with other Federal, state, local, and private restoration efforts. There is no potential for new town development within or contiguous to the area impacted by this alternative, and none would be developed in the future. Expansion of the current subdivisions would increase the tax base, thus increasing local government finances. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Tax Revenue and Property Values	*US & LA & SA:* Increasing population growth increases tax revenue and property values.	*US & LA & SA:* Increasing population growth increases tax revenue and property values.	*US & LA:* Increasing population growth increases tax revenue and property values. *SA:* Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions. At the same time, property values may drop from lowering aesthetics due to swamp degradation.	*US & LA:* Continued population growth increases tax revenue and property values. ALT 33 (Recommended Plan): This alternative would have little effect on tax revenue and property values when combined with other Federal, state, local, and private restoration efforts. Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions as well as due to increased aesthetics. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources– Community and Regional Growth	*US & LA & SA:* Increasing population growth increases community and regional growth.	*US & LA & SA:* Increasing population growth increases community and regional growth.	*US & LA:* Increasing population growth increases community and regional growth. *SA:* Additional increases in community and regional growth would be sustained through the filling of lots in the existing and proposed subdivisions.	*US & LA:* Continued population growth increases community and regional growth. ALT 33 (Recommended Plan): This alternative would have little effect on community and regional growth when combined with other Federal, state, local, and private restoration efforts. Additional increases in community and regional growth would be sustained through the filling of lots in the existing and proposed subdivisions. ALTS 34-39: Cumulative impacts would be similar to ALT 33.

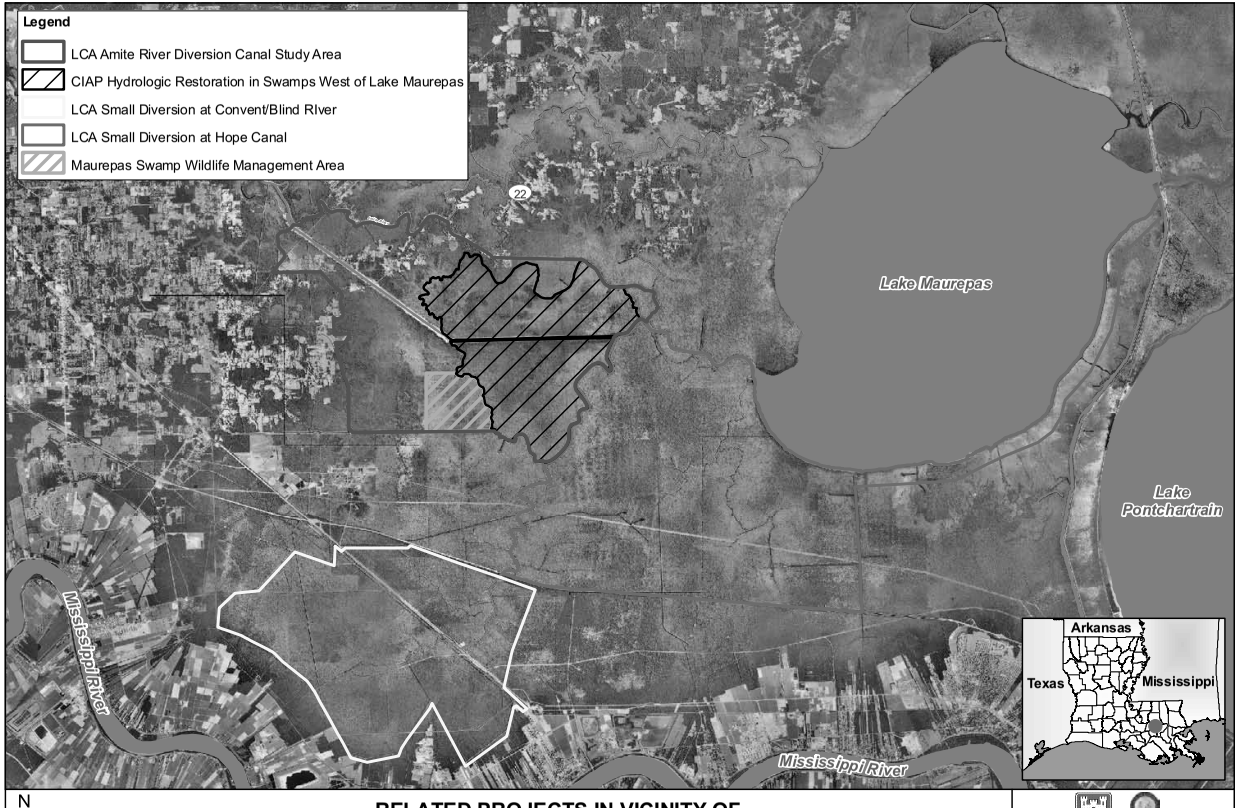
Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Socioeconomic and Human Resources – Land Use Socioeconomics-Agriculture	*US & LA:* Agriculture is important to the economy of the US and coastal Louisiana. *LA:* Important crops include sugar cane, rice, and soybeans. *SA:* Approximately 373 acres of agricultural lands, primarily livestock pastures are present.	US & LA: Agriculture is important to the economy of the US and coastal Louisiana. *LA:* Important crops include sugar cane, rice, and soybeans. *SA:* Approximately 373 acres of agricultural lands, primarily livestock pastures are present.	*US & LA:* Agriculture would continue to be important to the economy of the US and coastal Louisiana. *SA:* Agricultural lands, primarily livestock pastures, within the study area would continue to be used and may be adversely impacted by habitat conversion and land loss.	*US & LA:* Continued importance of agriculture to the economy of the US and coastal Louisiana. Agricultural lands may be adversely impacted by habitat conversion and land loss. ALT 33 (Recommended Plan): This alternative would have positive effects on agriculture when combined with other Federal, state, local, and private restoration efforts. There would be a reduced level of agriculture land habitat conversion and land loss compared to the No-Action Alternative. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Land Use Socioeconomics-Forestry	*US & LA:* Timber production is important to the economy of the US and Louisiana. *LA:* Timber has historically been important to the economy of Ascension and Livingston Parishes. *SA:* Timber was harvested extensively before 1940.	US & LA: Timber production is important to the economy of the US and Louisiana. LA: Timber continues to be important to the economy of Ascension and Livingston Parishes. SA: Increased interest in harvesting within the study area in recent years, but little harvesting is currently taking place.	US & LA: Timber production would continue to be important to the economy of the US and Louisiana. LA: Timber would continue to be important to the economy of Ascension and Livingston Parishes. SA: Little harvesting would likely take place in the future due to the lack of quality timber.	*US & LA:* Continued importance of timber production to the economy of the US and Louisiana. Timber lands may be adversely impacted by habitat conversion and land loss. ALT 33 (Recommended Plan): Channel Improvement, Flowage and Deposition, and Wetland Creation and Restoration easements would be placed within the primary and secondary areas of impact for Alternative 33 , effectively restricting timber harvesting within portions of the study area over an indefinite period of time. Therefore this alternative would have negative impacts on timber harvesting within portions of the study area. The Real Estate Plan in Appendix J provides descriptions of the easements which will be placed within the areas of impact. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Land Use Socioeconomics-Public Lands	*US & LA:* Public lands are important to the economy of the US and Louisiana. *SA:* A portion of the Maurepas WMA is the only public lands present.	*US & LA:* Public lands are important to the economy of the US and Louisiana. *SA:* A portion of the Maurepas WMA is the only public lands present.	*US & LA:* Public lands would continue to be important to the economy of the US and Louisiana. *SA:* A portion of the Maurepas WMA is the only public lands present. These lands may be adversely affected by future sea level rise and continued habitat conversion and land loss.	*US & LA:* Continued importance of public lands to the economy of the US and Louisiana. Public lands may be adversely impacted by habitat conversion and land loss. ALT 33 (Recommended Plan): This alternative would have positive effects on public lands when combined with other Federal, state, local, and private restoration efforts. There would be a reduced level of public land habitat conversion and land loss compared to the No-Action Alternative. At the same time, public lands may be adversely impacted by future sea level rise. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Navigation	*US, LA & SA:* Navigation interests have historically been a critical factor to national, state, and local interests. Growth of port facilities and inland waterways and traffic. Hurricanes Katrina and Rita impacted navigation infrastructure and investments. Public and private reinvestment to rebuild navigation, port facilities, and inland waterways. *SA:* One Federal navigation channel (Amite River and Bayou Manchac) and one Federal flood control channel (AR&T) are present. No major port or terminal installations are present.	*US, LA & SA:* Continued investment in port facilities and inland waterways. Navigation continues to be important part of the national transportation and commerce activities. *SA:* Amite River and Bayou Manchac Federal navigation channel and AR&T flood control channel are primarily used for recreational navigation.	*US & LA:* Continued investment in port facilities and inland waterways. Navigation continues to be important part of the national transportation and commerce activities. *SA:* Amite River and Bayou Manchac Federal navigation channel and AR&T flood control channel are likely to continue to be used primarily for recreational navigation.	*US & LA:* Continued investment in port facilities and inland waterways. Navigation continues to be important part of the national transportation and commerce activities. ALT 33 (Recommended Plan): This alternative would have positive effects on navigation when combined with other Federal, state, local, and private restoration efforts. Cumulative impacts would be the protection of navigation channels. ALTS 34-39: Cumulative impacts would be similar to ALT 33.

Table 5.1. Comparison of Cumulative Impacts*

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts (Comparison of Future With Proposed Action Impacts)
Socioeconomic and Human Resources – Man-Made Resources Oil, Gas, Utilities, and Pipelines	*US, LA, & SA:* Development of extensive network of oil and gas pipelines in mid-1900s. *SA:* Western Maurepas swamp experiences significant oil and gas exploration, primarily southwest of study area.	*US, LA, & SA:* Increasing O&M costs as well as increasing investment for oil and gas production facilities and pipelines, due to widespread coastal wetland loss. *SA:* Thirteen wells identified, plugged or abandoned or no oil produced; two inactive well bores and one active well bore; one active crude oil pipeline across northeastern corner.	*US, LA, & SA:* Increasing O&M costs as well as increasing investment in oil and gas production facilities and pipelines, increasing vulnerability of pipelines and other infrastructure due to widespread coastal wetland loss. *SA:* Wells likely to remain and active pipelines likely to be present.	*US & LA:* Continued investment in oil, gas, utilities, and pipelines. ALT 33 (Recommended Plan): This alternative would have positive effects on the protection of oil, gas, utilities, and pipelines when combined with other Federal, state, local, and private restoration efforts. These facilities would be less susceptible to storm surges and other damage due to wetland loss. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Man-Made Resources Flood Control and Hurricane Protection	*US & LA:* Flood of 1927 initiated national construction of hurricane and flood control levees, pump stations, and control structures. Hurricanes Katrina and Rita caused significant widespread damages to existing hurricane and flood control structures. *SA:* The AR&T flood control project was completed in 1964. Municipal and parish flood control measures, including drainage canals and control structures are present.	*US & LA:* Largest national restoration effort of hurricane and flood control in nation's history. *SA:* The AR&T Federal flood control project is present. Municipal and parish flood control measures including drainage canals and control structures are present.	*US & LA:* As populations continue to migrate to coastal communities, increasing investment in hurricane and flood control levees, pump stations, and other flood control facilities would be needed. *SA:* Continued degradation of wetlands would result in increases localized storm surge and storm wave damages.	*US & LA:* Continued loss of flood control and hurricane protection due to continued coastal and wetland degradation and loss. ALT 33 (Recommended Plan): This alternative would have positive effects on flood control and hurricane protection when combined with other Federal, state, local, and private restoration efforts. The proposed action would nourish and create swamp that is currently converting to open water, leaving adjacent areas more vulnerable to storm surges. Cumulative impacts include some protection of the ARDC and surrounding developments from storm damages. ALTS 34-39: Cumulative impacts would be similar to ALT 33.
Socioeconomic and Human Resources – Natural Resources Commercial Fisheries	*US, LA, & SA:* Institutional recognition, formation of NMFS and LDWF; Magnuson-Stevens Fishery Conservation and Management Act and amendments. Reduction in fisheries habitat, increased commercial catches, gear improvement, catch regulations. Commercial landings in the US in 2007 were nearly 4.2 million metric tons. Of the 528 individual stocks, 45 (24%) are overfished and 41 (17%) are subject to overfishing (NOAA). *LA:* Commercially important species, including brown and white shrimp, blue crabs, eastern oysters, and menhaden abundant. *SA:* Study area may provide some habitat for gulf menhaden and striped mullet but no commercial fishery for these species is present.	*US, LA & SA:* Continued institutional recognition and regulation of commercial fisheries. *LA:* Largest producer of shrimp, menhaden, blue crabs, and eastern oysters. *SA:* Study area may provide some habitat for gulf menhaden and striped mullet, but commercial fishery for these species is not present.	*US:* Institutional recognition continues; commercial fisheries decline expected as overfishing and habitat degradation and loss continues unless concerted efforts to protect, restore, and regulate a sustainable industry. *LA & SA:* Loss of commercial fishery habitat due to loss of essential wetland habitats and salinity changes.	*US & LA:* Institutional recognition continues; commercial fisheries decline expected as overfishing and habitat degradation and loss continues unless concerted efforts to protect, restore, and regulate a sustainable industry. ALT 33 (Recommended Plan): This alternative would have positive effects on commercial fisheries when combined with other Federal, state, local, and private restoration efforts. A net total of 1,602 acres of swamp habitat would be restored and nourished. Localized improvements of fishery habitats would provide some undetermined positive benefits to local commercial fisheries. ALT 34: Cumulative impacts similar to ALT 33 except 1,459 acres swamp habitat restored and nourished. ALT 35: Cumulative impacts similar to ALT 33 except 820 acres swamp habitat restored and nourished. ALT 36: Cumulative impacts similar to ALT 33 except 3,061 acres swamp habitat restored and nourished. ALT 37: Cumulative impacts similar to ALT 33 except 2,279 acres swamp habitat restored and nourished. ALT 38: Cumulative impacts similar to ALT 33 except 2,422 acres swamp habitat restored and nourished. ALT 39: Cumulative impacts similar to ALT 33 except 3,881 acres swamp habitat restored and nourished.
Hazardous, Toxic, and Radioactive Waste	*US, LA, & SA:* Institutional recognition under ER 1165-2-132. Establishment of the USEPA and LDEQ agencies. *SA:* Few potential HTRW sites are located near or within the study area.	*US, LA, & SA:* Continued institutional recognition. Increasing human populations and industrialization results in increased potential for HTRW problems. *SA:* Few potential HTRW sites are located near or within the study area.	*US, LA, & SA:* Continued institutional recognition. Increasing human populations and industrialization result in increased potential for HTRW problems.	*US & LA:* Increasing human populations worldwide. Increasing opportunity for HTRW problems. ALT 33 (Recommended Plan): There would be no cumulative impacts on HTRW. HTRW issues are unlikely to occur when combined with other Federal, state, local, and private restoration efforts. ALTS 34-39: Cumulative impacts would be similar to ALT 33.

**Includes Spatial/Geographic Extent (Continental United States [US], Louisiana [LA], and Study Area [SA], and Temporal (Past, Present, and Future with the No-Action Alternative). This cumulative impact analysis follows the 11-step process described in the 1997 report by the Council on Environmental Quality entitled "Considering Cumulative Effect Under the National Environmental Policy Act".*



RELATED PROJECTS IN VICINITY OF AMITE RIVER DIVERSION CANAL MODIFICATION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2007 Ascension, Livingston, St. James, St. John, and Tangipahoa Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 5.1
Date: July 2010
Scale:1:220,000
Source: NAIP/GEC
Map ID: 27850108-1381

Table 5.2. Net Acres[1] Created, Restored, and/or Protected by Other Federal, State, Local, and Private Restoration Efforts (LCA, 2004)

Program	Net Acres Created (LCA Subprovince 1)
Breaux Act CWPPRA[1]	33,690
State	2,543
PCWRP[2]	14
Mitigation Civil Works Projects[3]	4,990
Mitigation Regulatory Permits	6,411
Vegetation[4]	535
Section 204/1135, Beneficial Use	226
WRDA[5]	16,000
Other[6]	0
TOTALS	**64,410**

1 – CWPPRA acreages are based upon 20-year project life; all other acreages are 50 years.
2 – PCWRP = Parish Coastal Wetlands Restoration Program ("Christmas Tree Program").
3 – In the best-case scenario, compensatory mitigation (for civil works projects and regulatory permits) results in no net loss of wetlands. Hence, it is not the intent to imply that compensatory mitigation acreages would contribute to a net increase in wetlands as a result of the Clean Water Act Section 404 program. Rather, these figures represent an accounting of the various cumulative impacts to coastal wetlands from Federal, state, local, and private restoration efforts.
4 – Vegetation = LDNR/NRCS/Soil and Water Conservation Committee Vegetation Planting Program.
5 – WRDA = Completed Federal Water Resources Development Act projects, including the Davis Pond and Caernarvon diversions.
6 – Includes 30,558 acres (12,376 ha) restored and 340,348 (137,840 ha) acres enhanced by North American Wetlands Conservation Act (NAWCA), administered by the U.S. Fish and Wildlife Service (USFWS); unable to determine exact locations.
Source: The state, parish, FEMA, vegetation, WRDA, sections 1135/204, and beneficial use are from Belhadjali, Robertson, and Balkum (2002), Coastal Restoration Division Annual Project Reviews: December 2002. CWPPRA (Breaux Act) acres are from the District's November 2003 Task Force book and have been furnished by USFWS. Permit mitigation is from the District's Regulatory Branch database. Civil works mitigation is from the District's files. Other is 50,000 acres (20,250 ha) of non-mitigation land bought in fee in the Atchafalaya Basin by the District.

dissolved solids and turbidity, as well as potentially increase total metals and nutrients as they are released from the sediments. These impacts would be temporary and localized, lasting until the soils become compacted and vegetation is re-established. In addition, Best Management Practices (BMPs) would be used to minimize the amount of sediment entering the water, both during and after construction, until dredged material berms are vegetated.

Indirect. Indirectly, this alternative would improve hydrologic connectivity to a net total of 1,602 acres of wetland soils located between the ARDC and the adjacent swamp. Improved hydrologic connectivity would also allow nutrients and sediments to be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events. Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat deterioration. Finally, the establishment of hydrologic connectivity would reduce the likelihood of the swamp being converted to marsh or open water.

Cumulative. Alternative 33 would work additively with other projects within the general area to benefit soil resources including a net total of 1,602 acres of wetland soils would be hydrologically restored and nourished. The impacts to wetland soils within the study area and vicinity would be additive to some extent

with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.1.1.3 Alternative 34

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 3.4 acres of soil from the existing dredged material berm would be excavated and approximately 10.5 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 1,459 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.1.4 Alternative 35

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 2.4 acres of soil from the existing dredged material berm would be excavated and approximately 7.2 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 820 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.1.5 Alternative 36

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 6.0 acres of soil from the existing dredged material berm would be excavated and approximately 29.1 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 3,061 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.1.6 Alternative 37

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 5.8 acres of soil from the existing dredged material berm would be excavated and approximately 17.7 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 2,279 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be

similar to those described for Alternative 33 (Recommended Plan).

5.1.1.7 Alternative 38

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 5.0 acres of soil from the existing dredged material berm would be excavated and approximately 25.8 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 2,422 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.1.8 Alternative 39

Direct. Direct impacts of this alternative would be similar to Alternative 33 (Recommended Plan), except approximately 8.4 acres of soil from the existing dredged material berm would be excavated and approximately 44.0 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except 3,881 acres of swamp would be benefited.

Cumulative. Cumulative impacts of implementing this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2 Waterbottoms

5.1.2.1 No-Action Alternative

Direct. There would be no direct impacts to waterbottoms.

Indirect. Existing swamp habitat would continue to be converted to water bottoms. The decomposition of swamp vegetation would initially increase the availability of nutrients and detritus. However, the continued degradation from fresh marsh to shallow open water would ultimately decrease available nutrients and detritus.

Cumulative. Throughout coastal Louisiana, and within the study area, an increase in shallow water bottom acreage would occur in response to wetland loss. Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system (Figure 2.2), which would be additive with other swamp losses and degradation impacts to waterbottoms throughout the region, state, and nation. However, the impacts to waterbottoms in the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.1.2.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to waterbottoms would generally be associated with construction activities including dredging and placement of borrow material. A very small amount of waterbottom in the ARDC adjacent to the dredged material berm would also be excavated during the conveyance channel construction. Construction of the conveyance channels would create 18.6 acres of waterbottoms.

Indirect. Indirect impacts to waterbottoms would be related primarily to construction activities primarily associated with dredging and placement of dredged material for creation of BLH "islands". Construction of conveyance channels would decrease swamp habitat degradation, benefiting waterbottoms by providing increased dissolved organic compounds and detritus. Restoring hydrologic connectivity would contribute to re-establishing a wet-dry cycle to existing swamp waterbottoms, thereby increasing swamp vegetation productivity and health. In addition, dissolved organic compounds and detritus from the restored swamp vegetation would also increase the health and productivity of the swamp. A net total of 1,602 acres of swamp habitat and associated water bottoms would be benefitted by this alternative.

Cumulative. Throughout Coastal Louisiana, an increase in shallow water bottom acreage would occur in response to wetland loss. Implementation of Alternative 33 (Recommended Plan) would decrease the amount of waterbottoms created from the deterioration and conversion of existing swamp habitat to shallow open water habitat. The impacts to waterbottoms within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.1.2.3 Alternative 34

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 10.5 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 1,459 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2.4 Alternative 35

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 7.2 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 820 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2.5 Alternative 36

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 29.1 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 3,061 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2.6 Alternative 37

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 17.7 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 2,279 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2.7 Alternative 38

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 25.8 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 2,422 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.1.2.8 Alternative 39

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 36.3 acres of conveyance channel habitat would be created.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except approximately 3,881 acres of swamp habitat would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.2 HYDROLOGY

Hydrologic change is the main measure by which the swamps can be restored in the study area. Hydrologic restoration must account for the Relative Sea Level Rise (RSLR). Given the hydrologic influence of tidal Lake Maurepas and the regional subsidence conditions, RSLR could affect the computed flows in the proposed conveyance channels and the stage durations. In response to this concern, the Project Delivery Team (PDT) evaluated the potential impact of RSLR on the TSP/Recommended Plan. The evaluation adhered to guidelines established in Incorporating Sea Level Change Considerations in Civil Works Programs, EC 1165-2-211 (USACE, 2009a).

EC 1165-2-211 provides USACE guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Recent climate research by the Intergovernmental Panel on Climate Change predicts continued or accelerated global warming for the 21st Century and possibly beyond, which will cause a continued or accelerated rise in global mean sea-level. Impacts to coastal and estuarine zones caused by sea-level change must be considered in all phases of Civil Works programs.

In the preparation of the EC, USACE has relied entirely on climate change science performed and published by agencies and entities external to USACE. The EC documents this science and provides information on how to calculate three proposed sea level rise scenarios for use in projects.

The USACE guidance requires an assessment of project performance based on three estimates (low, intermediate, and high) of predicted relative sea level rise (RSLR). The low estimate reflects the local historic rate for the study area, based on long-term local gage data. The intermediate and high estimates reflect a combination of the local historic subsidence rate with either the modified NRC Curve I or the NRC Curve III estimate of eustatic sea level rise. The USACE New Orleans District prepared RSLR estimates in accordance with EC 1165-2-211 for LCA projects Amite River Diversion Canal and Small Diversion at Convent/Blind River (USACE, 2009b). The study areas for both projects are hydrologically independent; therefore any proposed actions would not result in ecosystem benefits or impacts between the two projects. The following estimates of RSLR account for both the eustatic rate of sea level rise and the local subsidence rate.

Low Rate RSLR - Consistent with guidance provided in EC1165-2-211, the USACE gauge at the West End in Lake Pontchartrain was used to calculate a representative historic rate for the project area. Daily stage data from 1959 to 2009

indicate a rate of 9.20 mm/yr (0.0302 ft/yr; see Figure 5.2) with a standard error of the linear trend line of 0.65 foot. Using the rate of 9.20 mm/yr, a starting year of 2012, and a 50-year period of analysis, the USACE projects a sea level rise of 1.5 feet for 2062. The rate of 9.20 mm/yr includes both the eustatic sea level rise and the local subsidence contributions to the estimated total RSLR.

Intermediate and High Rates - To estimate the local subsidence rate for the project area, the USACE subtracted the global eustatic rate (1.7 mm/yr) from the local sea level rate or

Local subsidence rate = 9.20 mm/yr – 1.7 mm/yr = 7.50 mm/yr.

The following formula yields an estimate of the total rise in eustatic sea level for the project life for the intermediate and high rate cases of sea level rise:

$$E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)$$

where: b=the acceleration factor for each curve, or 2.36E-5 and 1.005E-4, respectively, t_1=the time in years between the project's construction date and 1986, and t_2=the time between a future date at which one wants an estimate for sea level rise and 1986.

These eustatic estimates, when added to the local subsidence estimate, yield the total sea level rise for the intermediate and high rate cases. Table 5.3 presents a summary of the estimated total sea level rise in five-year increments through the 50-year period of analysis for each case. Figure 5.2 shows the estimated sea level rise for each case.

Table 5.3. Summary of Five-year Sea Level Rise for Each Case (USACE, 2009, Estimated Sea level Rise for Amite River Diversion and Convent/Blind River Diversion LCA Projects)

Project year	Low Rate (feet)	Intermediate Rate (feet)	High Rate (feet)
2012	0.0	0.0	0.0
2017	0.2	0.2	0.2
2022	0.3	0.3	0.5
2027	0.5	0.5	0.8
2032	0.6	0.7	1.1
2037	0.8	0.9	1.4
2042	0.9	1.1	1.7
2047	1.1	1.3	2.0
2052	1.2	1.5	2.4
2057	1.4	1.7	2.8
2062	1.5	1.9	3.2

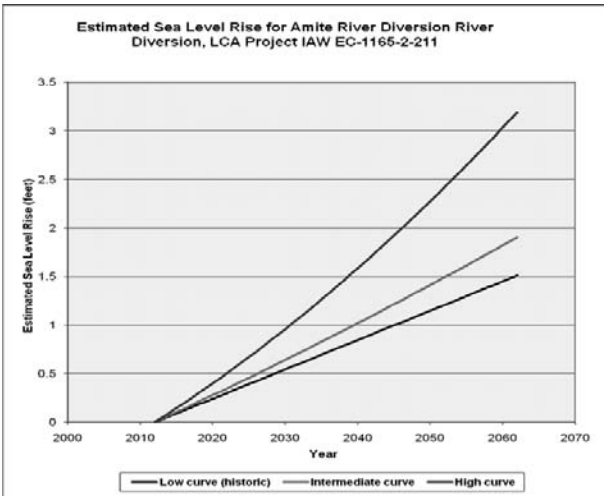


Figure 5.2. Plot of Sea Level Rise for Each Case (USACE, 2009, Estimated Sea level Rise for Amite River Diversion)

Impact of RSLR - The HEC-RAS models for the No-Action Alternative and the With Project Alternative for 2062 (Year-50) were rerun for the three RSLR cases by adding 1.5, 1.9, and 3.2 feet to the Amite River at the Maurepas hydrograph downstream boundary condition. Model results are presented in Tables 5.4, 5.5, and 5.6. The previous results (Year 1) for computed flows in the exchange channels versus computed Year 50 flows for low, intermediate, and high RSLR are included in Table 5.4. Similar comparisons of stage durations for the previously computed Year 1 versus Year 50 low, intermediate, and high RSLR for the No-Action Alternative and With Project Alternative in SE-1 and NE-2, respectively are presented in Tables 5.5 and 5.6 (SE-1 and NE-2 represent the subunits in which the cuts are located). As stages increase in Lake Maurepas due to RSLR, the flow in the proposed new conveyance channels increase (Table 5.4). RSLR would dramatically reduce the stage duration below 1.0 foot with both the No-Action Alternative and the With Project Alternative (Tables 5.5 and 5.6). The percentage of days with water surface elevation below 1.0 foot in the SE-1 and NE-2 areas falls from 37 and 48 percent, respectively, to zero under all three RSLR cases. It was determined that little differences existed between all seven alternatives, when modeled separately and together, therefore the With Project Alternative represents the implementation of all cuts.

Table 5.4. Computed Exchange Channel Flows with RSLR

With project with no RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6330	5298	4812	4368	4035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6874	7160	3392	3696	4088
% time of outflow	77%	78%	71%	72%	72%
With Project with 50 years of Low rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	23175	20734	14522	13503	12903
% time of inflow	35%	34%	54%	53%	52%
Volume outflow (ac-ft/yr)	32635	35202	7291	8187	8894
% time of outflow	65%	66%	46%	47%	48%
With Project with 50 years of Intermediate rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	28332	25659	15172	14131	13480
% time of inflow	36%	35%	56%	55%	54%
Volume outflow (ac-ft/yr)	41868	45382	7324	8397	9234
% time of outflow	64%	65%	44%	45%	46%
With Project with 50 years of High rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	36013	33138	15622	14617	14028
% time of inflow	39%	38%	56%	54%	52%
Volume outflow (ac-ft/yr)	57802	63338	74145	9374	11222
% time of outflow	61%	62%	44%	46%	48%

Table 5.5. Stage Duration with RSLR, Storage Area SE-1

	No-Action Plan							With Project Plan						
Without RSLR														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	213	2283	2742	2935	3059	3151	1352	2390	2770	2950	3070	3160		
% time at or below WSE	6%	62%	75%	80%	84%	86%	37%	65%	76%	81%	84%	86%		
Consecutive Days at or below WSE	73	120	138	164	203	204	114	121	152	164	203	205		
With Project with Low rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	0	15	60	89	120	0	8	62	104	162	206		
% time at or below WSE	0%	0%	0%	2%	2%	3%	0%	0%	2%	3%	4%	6%		
Consecutive Days at or below WSE	0	0	2	7	9	12	0	2	7	10	16	22		
With Project with Intermediate rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	0	0	0	3	7	0	0	3	12	24	38		
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%		
Consecutive Days at or below WSE	0	0	0	0	1	2	0	0	1	3	3	3		
With Project with High rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0		
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0		

Table 5.6. Stage Duration with RSLR, Storage Area NE-2

	No-Action Plan							With Project Plan						
Without RSLR														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	241	2306	2834	3027	3144	3233	1750	2501	2865	3032	3153	3236		
% time at or below WSE	7%	63%	78%	83%	86%	88%	48%	68%	78%	83%	86%	89%		
Consecutive Days at or below WSE	64	148	184	203	204	205	117	150	185	204	204	205		
With Project with Low rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	2	63	140	205	285	0	11	77	144	214	289		
% time at or below WSE	0%	0%	2%	4%	6%	8%	0%	0%	2%	4%	6%	8%		
Consecutive Days at or below WSE	0	2	8	12	17	22	0	5	8	12	17	22		
With Project with Intermediate rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	0	1	19	40	60	0	0	4	23	42	66		
% time at or below WSE	0%	0%	0%	1%	1%	2%	0%	0%	0%	1%	1%	2%		
Consecutive Days at or below WSE	0	0	1	3	3	8	0	0	2	3	3	5		
With Project with High rate of RSLR (50 years)														
Water Surface Elevation (WSE), feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5		
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654		
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0		
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0		

Estimates of the time in years to permanent inundation for the No-Action Alternative and Future with Project Alternative Plans (conditions are nearly the same for both swamp areas) are presented in Table 5.7. These estimates do not consider a rate for biomass and mineral sediment accretion. Biomass and mineral sediment accretion could extend the timeline until permanent inundation. It is estimated that within a healthy freshwater swamp habitat, accretion would result in approximately 8 mm/year within the study area (Bernard Wood, unpublished data, 2005 through 2009). It has also estimated that a net loss of substrate of 1 to 3 mm/year would occur within degraded areas of the Maurepas Swamp; therefore, a net accretion rate of 2.2 to 4.6 mm/year in healthy areas of the Maurepas Swamp (Shaffer and Bernard, unpublished data, 2005 through 2009). The net accretion estimates account for subsidence, but not eustatic sea level rise.

Table 5.7. Years to Permanent Inundation

RSLR Case	RSLR Year 50	No-Action	With Project
Low Rate	1.5 feet	14 years	40 years
Intermediate Rate	1.9 feet	12.5 years	31 years
High Rate	3.2 feet	8 years	17 years

The rates of sea level rise and the rate of accretion relative to the existing elevation of the swamp is depicted for reference in Figures 5.3 through 5.5. These graphs illustrate that under the FWP condition, accretion will not keep up with RSLR for any of the three forecasts. However, the figures do illustrate that a substantial reduction of the RSLR impacts under the FWOP condition is obtained. As stated in Section 3.5.2, benefits will be achieved even after permanent inundation occurs. Therefore, the reduction in the impacts of RSLR observed through biomass accretion would prolong the benefits obtained and increase sustainability for all three estimates.

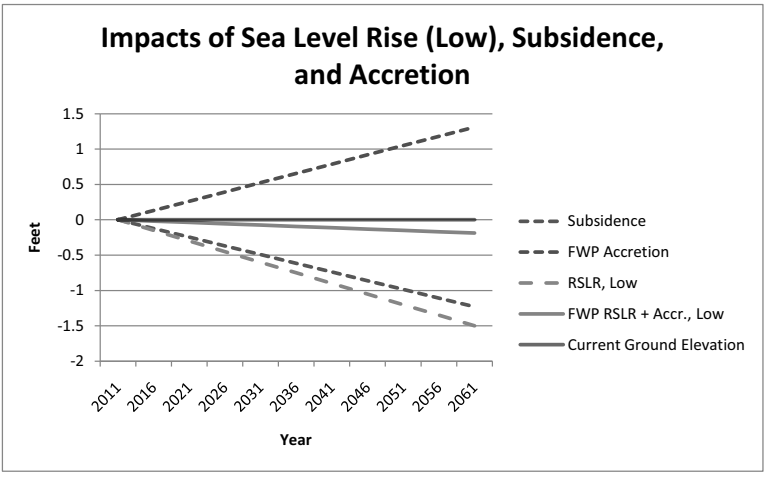


Figure 5.3. Combined Effects of Low RSLR Estimate and Accretion

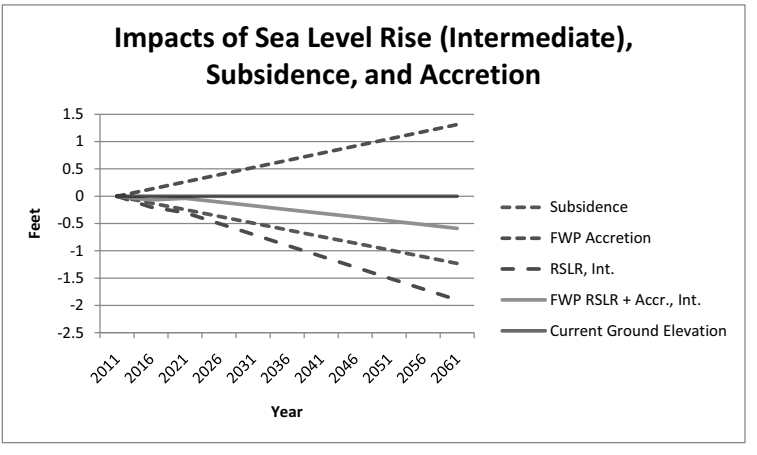


Figure 5.4. Combined Effects of Intermediate RSLR Estimate and Accretion

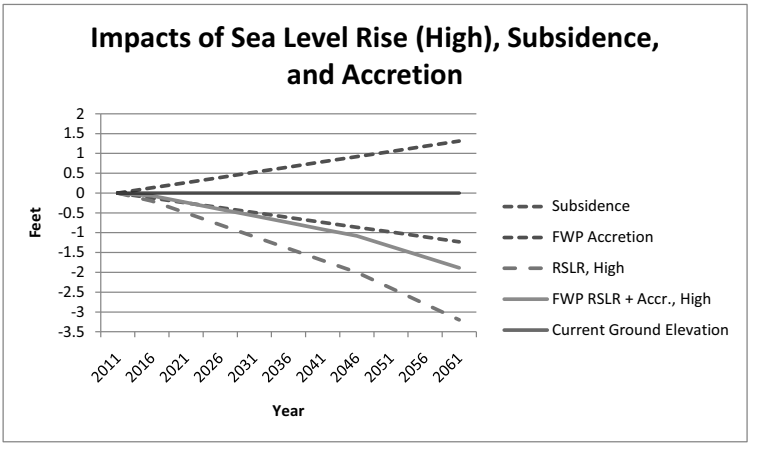


Figure 5.5. Combined Effects of High RSLR Estimate and Accretion

As part of the analysis of RSLR in the Future With Project (FWP) condition, the Wetland Value Analysis model (WVA) was performed on all three scenarios of predicted sea level rise for the NER plan and the Recommended Plan. The results showed a decrease of approximately seven percent when the intermediate estimate was modeled and a decrease of approximately 10 percent with the high estimate. The results of this analysis may be seen in Table 5.8.

Table 5.8. Effect of RSLR on Alternatives

Effect of Relative Sea Level Rise on Alternatives			
Alternative	**Low SLR (AAHUs)**	**Intermediate RSLR (AAHUs)**	**High RSLR (AAHUs)**
33	679	640	610
34	589		
35	334		
36	1,268		
37	922		
38	1,013		
39	1,602	1,516	1,452

Results of Relative Sea Level Rise Analysis - Proposed conveyance channels would meet the hydrodynamic objectives of the project. Proposed

conveyance channels would improve the hydrologic connections of the ARDC and the adjacent swamp, as well as facilitating development of a more natural wet-dry cycle within the swamp. The effects of RSLR would reduce the improvements by reducing the dry periods within the associated areas of impact. Increased connectivity for water flow, nutrients, and sediments will still benefit the freshwater swamp, even in the event of permanent inundation. As stated in Section 3.5.2, low oxygen and reducing conditions restrict tree growth in inundated conditions. Improved flow would increase oxygen and improve tree vigor, even in fully inundated conditions (Gary Shaffer, personal communication, October 2009).

It has also been recognized that organic material would accumulate in the ARDC study area, thereby playing a role in reducing the overall effects of relative RSLR. According to studies performed near the study area, organic buildup of approximately 8 mm/yr has been observed near healthy cypress trees over the past 10 years (Bernard Wood, unpublished data, 2005 through 2009). This indicates that accretion, within a healthy swamp with adequate sediment and nutrient exchange, may reduce the potential impacts of RSLR.

The proposed conveyance channels may cause an inconsequential increase in peak flood stages in the swamps near the ARDC, and a minor decrease in peak flood stages in the Amite River and ARDC. The Recommended Plan would not increase the flood risk to houses and developments within the study area.

Any future development along the dredged material berms within the areas of impact would have no effect on the benefits generated by the final array of alternatives, as hydrologic connectivity would still be established between the ARDC and the interior swamp habitat.

5.2.1 Flow and Water Levels

5.2.1.1 No-Action Alternative

Direct. No direct impacts to flow and water levels, except there would be an increase in water levels due to sea level rise.

Indirect. Indirect impacts of not implementing wetland restoration would result in the persistence of existing conditions. Water flow into and out of the swamp would remain inhibited by the dredged material berms, resulting in continued impoundment of, and lack of connectivity to the adjacent swamp habitat. This continued impoundment and lack of connectivity would continue to stress and degrade the swamp habitat, converting from fresh marsh to open water.

Cumulative. Cumulative impacts of not implementing restoration actions and reconnecting hydrologic flows between the Maurepas Swamp and adjacent waters would result in the continued degradation and conversion of 18,204 acres of existing swamp habitat to marsh and shallow open water habitat. Water flows into and out of the swamp would continue to be impeded by the existing dredged

material berms along the ARDC. Water levels within the impounded study area would likely increase due to projected rise in sea level. The conversion of 18,204 acres of existing swamp habitat to a shallow open water system would be in addition to other swamp habitat losses and degradation impacts to flows and water levels throughout the region, state and nation (see Figure 5.1 and Table 5.2).

5.2.1.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts would be an increase in water flow into and out of the swamp areas, along with more variable water levels indicative of a more natural wet-dry cycles for 1,602 acres of swamp, depending on ARDC stages and tidal activity. With added conveyance, increases in flow and water level fluctuations would occur within more interior portions of the project area.

Indirect. The addition of three cuts in the ARDC dredged material berm would reconnect the hydrology and increase flows into and out of 1,602 acres of swamp, resulting in positive effects on water levels and flows. There would be an overall net gain of 679 Average Annual Habitat Units (AAHUs).

Cumulative. Cumulative impacts to water flow and water levels would primarily be associated with incremental impacts of similar wetland restoration projects in and near the study area as well as throughout coastal Louisiana (see Figure 5.1 and Table 5.2). Water levels would likely fluctuate in response to ARDC and sea level rises, which would likely have a cumulative effect when considering the overall freshwater swamp degradation in the Lake Maurepas area.

5.2.1.3 Alternative 34

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 1,459 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 1,459 acres (589 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 1,459 acres of swamp would be benefited.

5.2.1.4 Alternative 35

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 820 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 820 acres (334 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 820 acres of swamp would be benefited.

5.2.1.5 Alternative 36

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 3,061 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 3,061 acres (1,268 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 3,061 acres of swamp would be benefited.

5.2.1.6 Alternative 37

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 2,279 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 2,279 acres (922 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 2,279 acres of swamp would be benefited.

5.2.1.7 Alternative 38

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 2,422 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 2,422 acres (1,013 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 2,422 acres of swamp would be benefited.

5.2.1.8 Alternative 39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) except increased flow and water level variability would occur in 3,881 acres of swamp.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) except that this alternative would benefit 3,881 acres (1,602 AAHUs).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan) except 3,881 acres of swamp would be benefited.

5.2.2 Sedimentation and Erosion

5.2.2.1 No-Action Alternative

Direct. There would be no direct impacts to sediment supply to or from the swamp. The sediment in the waters of the ARDC is primarily suspended fines that would be prevented from entering the swamp by the dredged material berms of the ARDC. The sediment would not be able to be supplied to the system, increasing the impacts of erosion, subsidence, and swamp degradation.

Indirect. The swamp health would continue to degrade due to the lack of connectivity and lack of sediment and nutrient input.

Cumulative. Cumulative effects include the continued impaired sediment supply due to urbanization and the resulting degradation of coastal wetlands, as well as the benefits and impacts of other state and Federal projects in the vicinity (see Figure 5.1 and Table 5.2). Subsidence and RSLR would likely continue to occur at a rate greater than sediment deposition, resulting in a net lowering of land surface throughout much of coastal Louisiana. Within the study area, tropical storms may cause some redistribution of sediments to and from the swamp and surrounding waterways, but the ARDC existing dredged material berms would continue to block hydrologic exchange and, therefore, sedimentation. Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system, which would be additive with other swamp losses and degradation impacts to sedimentation and erosion throughout the region and state.

5.2.2.2 Alternative 33 (Recommended Plan)

Direct. The direct impact would be the connectivity and sediment accretion from the ARDC into the swamp system on approximately 1,602 acres. The appropriate BMPs would be implemented to limit the introduction of sediments into receiving waters, such as the ARDC, during construction.

Indirect. The indirect benefits would improve swamp health due to the connectivity and placement of sediment on the swamp floor on approximately 1,602 acres.

Cumulative. Cumulative impacts to sediments would primarily be associated with incremental impacts of similar wetland creation and nourishment features. Cumulative impacts would be the effect of the additive combination of impacts and benefits for overall net acres nourished, and protected by other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Alternative 33 (Recommended Plan) would interact with these projects to provide an increase in the introduction of sediments for the swamp habitat within the western Maurepas Swamp, thereby benefiting 1,602 acres, which would have a cumulative effect when considering the overall freshwater swamp degradation in the Lake Maurepas area. This would reduce the conversion of the estimated 18,204 acres of swamp to open water. Further development and other factors, such as sea

level rise, would continue to have a negative effect, leading to further swamp degradation within coastal Louisiana.

5.2.2.3 Alternative 34

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 1,459 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 1,459 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 1,459 acres of swamp would be benefited.

5.2.2.4 Alternative 35

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 820 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 820 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 820 acres of swamp would be benefited.

5.2.2.5 Alternative 36

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 3,061 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 3,061 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 3,061 acres of swamp would be benefited.

5.2.2.6 Alternative 37

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 2,279 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 2,279 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 2,279 acres of swamp would be benefited.

5.2.2.7 Alternative 38

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 2,422 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 2,422 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 2,422 acres of swamp would be benefited.

5.2.2.8 Alternative 39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan), except the settlement of sediment on the swamp floor would occur over approximately 3,881 acres.

Indirect. The indirect impacts would be similar to Alternative 33 (Recommended Plan), except accretion and improved swamp health would occur over approximately 3,881 acres of swamp floor.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 3,881 acres of swamp would be benefited.

5.2.3 Water Use and Supply

5.2.3.1 No-Action Alternative

Direct. There would be no direct impacts to water use and supply.

Indirect. There would be no indirect impacts to water use and supply.

Cumulative. Water use would increase with population growth, placing more demand on the water supply. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to water use and supply throughout the region and state. This conversion of swamp habitat to open water habitat would likely reduce water purification function of forested wetlands. However, the impacts to water use and supply within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.2.3.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct effects to water use and supply as a result of Alternative 33 (Recommended Plan).

Indirect. There would be no indirect effects to water use and supply as a result of Alternative 33 (Recommended Plan).

Cumulative. Water use and supply would likely continue to increase throughout the country and region, while implementation of Alternative 33 (Recommended Plan) and the corresponding reconnected hydrology of swamp would likely result in improved water purification function within the study area. The impacts to water use and supply within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.2.3.3 Alternatives 34-39

Direct. There would be no direct effects to water use and supply.

Indirect. There would be no indirect effects to water use and supply.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.2.4 Groundwater

5.2.4.1 No-Action Alternative

Direct. There would be no direct impacts to groundwater.

Indirect. Indirect adverse impacts include decreases in groundwater resources as a result of increased demand for groundwater as a water supply source due to the increasing populations of Ascension and Livingston Parishes.

Cumulative. Cumulative impacts would include the overall reduction of groundwater due to population, agriculture and industry increases throughout coastal Louisiana. Increasing populations in Ascension and Livingston Parishes are expected to stress groundwater resources by increased demands for groundwater as a water supply. Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system, which would be additive with other swamp losses and degradation impacts to groundwater throughout the region and state. However, the impacts to groundwater within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.2.4.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct effects on groundwater.

Indirect. There would be no indirect effects on groundwater.

Cumulative. Rising populations in Ascension and Livingston Parishes are expected to stress groundwater resources by increased demands for groundwater as a water supply. No groundwater impacts would likely result upon implementation of Alternative 33 (Recommended Plan) within the study area as groundwater is supplied by the Chicot Equivalent aquifer. The impacts to groundwater within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.2.4.3 Alternatives 34-39

Direct. There would be no direct effects on groundwater.
Indirect. There would be no indirect effects on groundwater.
Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.3 WATER QUALITY AND SALINITY

A draft Total Maximum Daily Load (TMDL) has been submitted by the Louisiana Department of Environmental Quality (LDEQ) and proposes a 60 percent reduction in non-point source (NPS) load within the ARDC in order to achieve current water quality standards. However, the LDEQ is in the process of conducting an ecoregional use attainability analysis that they suspect will modify the water quality standard such that the required NPS load reduction will be reduced to 25 percent.

5.3.1 Water Quality

5.3.1.1 No-Action Alternative

Direct. There would be no direct impacts to water quality.
Indirect. Potential indirect impacts include further degradation of the cypress-tupelo swamp due to the lack of water exchange. Current water quality conditions would persist in surface waters in the impounded swamp habitat adjacent to the ARDC and within the flowing systems. Conversion of the forested swamp to fresh marsh and ultimately open water would cause changes to surface water chemistry, including a seasonal increase in salinity as salt water moves more easily upstream from Lake Maurepas, and the potential for the release of nutrients that are currently retained in the swamp soils. The water quality within the swamp would contribute to the continued degradation of the swamp due to the increased stress on the plants because of the lack of connectivity and to the conversion of the swamp, initially to fresh marsh, and ultimately to open water.
Cumulative. While the impending implementation of the TMDLs in the study area would likely offset any new impacts from an increased human presence in the region, the No-Action Alternative would likely result in changes to water

quality as the forested swamp continues to degrade to fresh marsh and ultimately open water. Continued conversion of swamp habitat to marsh and open water throughout the region would reduce the natural filtration of water. Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system, which would be additive with other swamp losses and degradation impacts to water quality throughout the region and state. However, the impacts to water quality within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

Draft TMDLs have been received for the two LDEQ subsegments that encompass the study area and are scheduled to be completed in 2011 for the current causes of the Fish and Wildlife Propagation use impairment, including mercury, chloride, and total dissolved solids (TDS). Water quality conditions in the study area and vicinity could possibly improve the implementation of the TMDLs in conjunction with other existing water quality programs. However, the potential increase in human activities that could have adverse effects on water quality would also continue to occur in the future, such as increased wastewater and polluted stormwater runoff generated by increased development in the Pontchartrain Basin, and the potential discharge of untreated or poorly-treated sewerage.

5.3.1.2 Alternative 33 (Recommended Plan)

Direct. Implementation of Alternative 33 (Recommended Plan) would directly impact water quality by introducing sediments into both the ARDC and into the swamps. Water introduction would temporarily increase total suspended and dissolved solids and turbidity in the swamp. Appropriate BMPs should be used to minimize the amount of sediment entering the ARDC and receiving waterbodies, both during and after construction, until dredged material berms are vegetated. There would also be some minor and temporary adverse direct impacts to water quality due to increased turbidity during and immediately following the construction phase.

Restoring hydraulic connectivity would temporarily and periodically allow impounded swamp waters that are potentially low in dissolved oxygen (DO), and high in biological oxygen demand (BOD), chlorides and nutrient content to enter the ARDC and receiving waterbodies. The introduction of waters of poorer quality from the swamp may impair the water quality in the receiving waters. Alternatively, water with presumably higher DO and lower BOD, chlorides and nutrient content would be allowed to flow into the forested swamp areas, thus improving the water quality within the swamp. These higher quality waters, in conjunction with the other benefits of this project, are expected to improve the health of the forested swamp.

Indirect. Indirect impacts include the improvement of water quality conditions within the forested swamp, thereby indirectly improving the growth and health of the cypress-tupelo forest. There would also be some minor and temporary

adverse impacts to water quality due to increased turbidity during and immediately following the construction phase.

Cumulative. Increases in demand corresponding with increased human population and industrialization within the region would likely create a potential for water quality problems within the U.S. and Louisiana. The cumulative impacts of implementing Alternative 33 (Recommended Plan) may include temporary and periodic impacts to the water quality in the receiving waters within the study area, but ultimately should improve water quality conditions, and the overall health of the forested swamp, with the additional benefits that the healthy and intact forested wetland environment would provide for 1,602 acres. The impacts to water quality within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.3.1.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.3.2 Salinity

5.3.2.1 No-Action Alternative

Direct. Storm surges from tropical cyclone events would increase salinity levels within the study area. The existing impoundments would retain higher salinity water within the study area and cause it to absorb into the substrate. The frequency of saltwater inundation is expected to increase with RSLR.

Indirect. Vegetation within the impounded forested swamp areas would be subject to salt stress when saline waters are not freely flushed from the system. Flora and fauna species may change over time as salt-tolerant species replace fresh water species as the swamp turns to marsh and open water.

Cumulative. Cumulative impacts would include the negative impacts of increased salinity levels moving further inland along coastal Louisiana, which leads to the degradation of wetland vegetation and furthers coastal and bottomland habitat loss, together with the benefits and impacts of other state and Federal projects in the vicinity. The regional effects of RSLR may also play a role in increasing salinity levels within the region. Within the study area, the continual impoundment and lack of hydrologic connectivity would likely result in higher residence times and higher salinity levels. Overall cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system, which would

be additive with other swamp losses and degradation throughout the region and state. However, the impacts to salinity levels within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.3.2.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts of Alternative 33 (Recommended Plan) would include the introduction of fresh water into 1,602 acres of forested swamp, reducing the salinity, chloride, and total dissolved solids concentrations within the impacted areas.

Indirect. Existing vegetation within the impounded forested swamp areas should benefit by the input of fresh water to the system. The implementation of Alternative 33 (Recommended Plan) would partially restore the cycle of inundation and drying of the swamp that halted with the construction of dredged material berms. The periodic introduction of freshwater would help to decrease salt water retention or absorption in the study area, thus helping to prevent the continued degradation of the forested wetland.

Cumulative. The regional effects of RSLR may play a role in increasing salinity levels within the surrounding areas of coastal Louisiana. The cumulative impacts of implementing Alternative 33 (Recommended Plan) may include the reduction of salinity levels within the study area due to the restored hydrologic connectivity of 1,602 acres of swamp habitat. The impacts to salinity levels within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.3.2.3 Alternative 34

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although slightly reduced in scale because fewer cuts are proposed in Alternative 34 and a smaller area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although slightly reduced in scale because fewer cuts are proposed in Alternative 34 and a smaller area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 1,459 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.3.2.4 Alternative 35

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although greatly reduced in scale because only one cut is proposed in Alternative 35 and a smaller area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although greatly reduced in scale because only one cut is proposed in Alternative 35 and a smaller area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 820 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.3.2.5 Alternative 36

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although increased in scale because one additional cut is proposed in Alternative 36 and a larger area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although increased in scale because one additional cut is proposed in Alternative 36 and a larger area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 3,061 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.3.2.6 Alternative 37

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although reduced in scale, because one less cut is proposed in Alternative 37; however a larger area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although reduced in scale because one less cut is proposed in Alternative 37; however a larger area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 2,279 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.3.2.7 Alternative 38

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although slightly increased in scale because one additional cut is proposed in Alternative 38 and a larger area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although slightly increased in scale because one additional cut is proposed in Alternative 38 and a larger area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 2,422 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.3.2.8 Alternative 39

Direct. Direct impacts would be similar to that in Alternative 33 (Recommended Plan), although greatly increased in scale because two additional cuts are proposed and a larger area of swamp would be impacted.

Indirect. Indirect impacts would be similar to that in Alternative 33 (Recommended Plan), although greatly increased in scale because two additional cuts are proposed and a larger area of swamp would be impacted.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except 3,881 acres of swamp habitat would benefit from restored hydrologic connectivity.

5.4 AIR QUALITY

5.4.1 No-Action Alternative

Direct. There would be no direct adverse impacts on air quality.

Indirect. There would be no indirect impacts of not implementing hydrologic connectivity within the study area, which would result in the persistence of existing conditions. Most of the study area consists of remote, uninhabited swamp.

Cumulative. Continued institutional recognition, along with the continued deterioration of air quality throughout the nation and region, due to increases in population and industrialization, would likely occur. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to air quality throughout the region and state, because of reductions in function of swamp vegetation to act as natural filters for air pollution. However, the impacts to air quality within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.4.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to ambient air quality would be temporary and localized, resulting primarily from the emissions of construction equipment within the study area. Direct impacts to air quality, specifically emission levels for nitrous oxide (NOx) and volatile organic compounds (VOCs) are quantified in Tables 5.9 and 5.10.

Indirect. Over the 50-year period of analysis, Alternative 33 (Recommended Plan) would likely result in the restoration of 1,602 acres of swamp vegetation, increasing the habitat's ability to filter the air and improve local air quality by reducing particulates and gaseous air pollutants.

Cumulative. Continued deterioration of air quality throughout the nation and region, due to increases in population and industrialization, would likely occur. These impacts to air quality within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.4.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.5 NOISE

5.5.1 No-Action Alternative

Direct. There would be no direct impacts on noise.

Indirect. There would be no indirect impacts on noise.

Cumulative. There would be no cumulative impacts of the No-Action Alternative on noise.

5.5.2 Alternative 33 (Recommended Plan)

Direct. Construction activities associated with implementing Alternative 33 (Recommended Plan) would temporarily increase the noise levels in the construction areas. However, the areas of impact are remote and unpopulated, so the noise level would not affect any nearby human communities. In some instances, noise impacts may directly impact fish and wildlife species temporarily. These organisms would generally avoid the construction area; returning once construction activities cease. Potential noise impacts from construction activities, although construction equipment is limited in the level of noise that can be emitted. Institutional recognition of noise, such as provided by the regulation for Occupational Noise Exposure 929 CFR Part 1910.95) under the Occupational Safety and Health Act of 1970, as amended, would continue. This section mandates that noise levels emitted from construction equipment be below 90 dB for exposures of eight hours per day or more. Once construction activities are completed, noise levels would return to preconstruction conditions.

Table 5.9. Air Quality Emission Analysis for Nitrous Oxide

This table lists the equipment that will be used for the earth moving phase of this project, and details an estimate of the amount of expected emission of Nitrous Oxide for the duration of the project.

Air Quality Emission Analysis for Nitrous Oxide											
Units	Equipment Item	Total Work Hours	Work House Per Unit	Fuel Type Gas	Diesel	hp	Multiplying Factor % hp	Time	Total hp Hours	Annual hp Hours
1	Crew Boat	880	880		D	874	0.83	0.8	510695.68	510695.68
1	Dozer D-6	400	400		D	100	0.83	0.7	23240	23240
1	Log Skidder 517	400	400		D	120	0.83	0.7	27888	27888
1	Marsh Backhoe/CAT 330	1680	1680		D	222	0.83	0.7	216689.76	216689.76
1	Tugboat 900 horsepower (hp)	160	160		D	900	0.83	0.8	95616	95616
1	Barge	840	840			0			0	0
	TOTAL GASOLINE (hp hours)									
	TOTAL DIESEL (hp hours)								874129.44	874129.44
	[1]Nox Emission Factors (lbs/hp hours)	Gas	Diesel							
		0.011	0.031							
							Emissions			Tons
							Gas			0.00
							[2]Diesel			13.55
							Subtotal			13.55

[1]Nox emission factors were obtained per guidance AP 42. Additional information may be obtained at www.epa.gov/ttnchie1/ap42/.

[2]Estimated Nox emissions were calculated by multiplying total diesel hp hours by the diesel Nox emission factor (lbs/hp hours), divided by 2000 to obtain tons (874129.44*0.031/2000).

5.10. Air Quality Emission Analysis for Volatile Organic Compounds

This table lists the equipment that will be used for the earth moving phase of this project, and details an estimate of the amount of expected emission of Volatile Organic Compounds for the duration of the project.

Air Quality Emission Analysis for Volatile Organic Compounds

Units	Equipment Item	Total Work Hours	Work House Per Unit	Fuel Type Gas	Diesel	hp	Multiplying Factor % hp	Time	Total hp Hours	Annual hp Hours
1	Crew Boat	880	880		D	874	0.83	0.8	510695.68	510695.68
1	Dozer D-6	400	400		D	100	0.83	0.7	23240	23240
1	Log Skidder 517	400	400		D	120	0.83	0.7	27888	27888
1	Marsh Backhoe/CAT 330	1680	1680		D	222	0.83	0.7	216689.76	216689.76
1	Tugboat 900 hp	160	160		D	900	0.83	0.8	95616	95616
1	Barge	840	840			0			0	0
	[1]VOC Emission Factors (lbs/hp hours)	Gas	Diesel						874129.44	874129.44
	Exhaust	0.015	0.00247							
	Evaporation	0.000661	0				Emissions			Tons
	Crankcase	0.00485	0.0000441				Gas			0.00
	Refueling	0.00108	0				[2]Diesel			1.10
	Total	0.021591	0.0025141				**Subtotal**			1.10

[1]VOC emission factors were obtained per guidance AP 42. Additional information may be obtained at www.epa.gov/ttnchie1/ap42/.
[2]Estimated VOC emissions were calculated by multiplying total diesel hp hours by the total diesel VOC emission factors (lbs/hp hours), divided by 2000 to obtain tons (874129.44*0.0025141/2000).

Indirect. Localized and temporary noise impacts would likely result in wildlife and fishery resources, temporarily leaving the areas of impact during construction activities, reducing the wildlife viewing opportunities. However, indirect impacts due to noise are expected to be localized, temporary, and minor.

Cumulative. The cumulative impacts would principally be related to the potential short-term disruption of fish and wildlife species. The continued increases in noise throughout the nation and region, due to increases in population and industrialization, would likely occur. Ambient noise from boats, airboats, and other human activities would continue to cause some minimal and temporary disturbances in the study area. Long-term adverse cumulative impacts within the study area due to noise levels are not expected.

5.5.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6 VEGETATION RESOURCES

5.6.1 Riparian Vegetation Resources

5.6.1.1 No-Action Alternative

Direct. There would be no direct impacts to riparian vegetation.

Indirect. There would essentially be no impact to riparian vegetation.

Cumulative. Riparian vegetation along ARDC berms likely unchanged over 50-year period of analysis. However, the impacts to riparian vegetation resources within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.1.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts would include the loss of riparian vegetation resources located along the ARDC dredged material berms to open water habitat due to the construction of the conveyance channel (Figure 3.4). There would be approximately 16,101 linear feet of conveyance channel created and approximately 7.4 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this

habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat due to effects of the construction.

Cumulative. This alternative would have positive effects on riparian vegetation when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There would be creation of riparian habitat along conveyance channels. Riparian vegetation on dredged material berms would be impacted by construction

5.6.1.3 Alternative 34

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms due to the construction of the conveyance channel (Figure 3.10). There would be approximately 8,483 linear feet on conveyance channel created and approximately 3.9 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channel and the conversion of 3.9 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.1.4 Alternative 35

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms due to the construction of the conveyance channel (Figure 3.11). There would be approximately 5,930 linear feet on conveyance channel created and approximately 2.7 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channels and the conversion

of 2.7 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.1.5 Alternative 36

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms due to the construction of the conveyance channel (Figure 3.12). There would be approximately 24,493 linear feet on conveyance channel created and approximately 11.3 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channels and the conversion of 11.3 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.1.6 Alternative 37

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms due to the construction of the conveyance channel (Figure 3.13). Approximately 10.1 acres of freshwater swamp would be converted into riparian habitat; approximately 4.9 would be converted dredged material placement and 5.2 acres would be cleared work areas (Table 3.4). There would be approximately 14,413 linear feet on conveyance channel created and approximately 6.7 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channels and the conversion of 6.7 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.1.7 Alternative 38

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms due to the construction

of the conveyance channel (Figure 3.14). There would be approximately 21,940 linear feet on conveyance channel created and approximately 10.1 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channel and the conversion of 15.2 acres of freshwater swamp to riparian habitat and the conversion of 10.1 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.1.8 Alternative 39

Direct. Direct impacts would include the conversion of riparian vegetation resources located along the ARDC dredged material berms would be permanently lost due to the construction of the conveyance channel (Figure 3.15). There would be approximately 30,423 linear feet on conveyance channel created and approximately 14.0 acres of riparian habitat created adjacent to the channel. All riparian habitats temporarily impacted or created would be replanted for the improvement of this habitat. The dredged material placement berms would be replanted with the appropriate BLH species, and the rest of the area impacted by the construction of the conveyance channel and dredged material placement would be planted with freshwater swamp species.

Indirect. There would be minor indirect impacts to riparian habitat.

Cumulative. Cumulative impacts would include the direct minor loss of riparian habitat due to construction of the conveyance channel and the conversion of 14 acres of freshwater swamp to riparian habitat and the conversion of 7.4 acres of freshwater swamp to riparian habitat. Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.2 Wetland Vegetation Resources

The acres of vegetative degradation resulting from the No-Action alternative and the acres of freshwater swamp and bottomland hardwood habitat benefited through implementation of the final array are found in Table 5.11.

Table 5.11. Degradation and Benefits for Final Array

Years to Marsh	Study Area Degradation (Acres)	Benefits Achieved from Final Array (Acres)						
	No-Action	33	34	35	36	37	38	39
Existing Marsh	300	144	146	0	290	146	144	290
10 Years to Marsh	1,723	241	775	0	1,016	775	241	1,016
20 - 3- Years to Marsh	7,979	975	299	542	1,274	841	1,518	1,816
30 - 50 Years to Marsh	8,202	242	239	278	481	517	519	759
Total Acres	**18,204**	**1,602**	**1,459**	**820**	**3,061**	**2,279**	**2,422**	**3,881**

5.6.2.1 No-Action Alternative

Direct. There would be no direct impacts to wetland vegetation resources.

Indirect. The lack of connectivity for freshwater, nutrient, and sediment exchange would continue to degrade the wetland habitat. Additionally, impoundment caused by the dredged material berms would continue to cause degradation to the freshwater swamp habitat. The freshwater swamp would degrade to freshwater marsh and eventually to open water. Functions lost include habitat for wildlife and aquatic species, recreational opportunities, aesthetics, and storm surge protection. Upon severe degradation, the swamp will convert to freshwater marsh, then to open water. The freshwater marsh does offer some of the functions of the freshwater swamp, but certain functions are lost, such as habitat for avian species and storm surge protection.

Cumulative. Cumulative impacts would be the continued degradation effects of coastal land loss due to hydrologic impairment, development, subsidence, sea level rise, and saltwater intrusion. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to wetland vegetation throughout the region and state. However, the impacts to wetland vegetation resources within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.2.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts would include the conversion of approximately 31.2 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.4). Approximately 18.6 acres would be converted to conveyance channel, 5.0 acres would be converted to dredged material placement berm habitat, and 7.6 acres would be temporarily impacted by the construction (Table 3.4). Temporary work areas would be replanted with freshwater swamp species, and the

dredged material berms would be planted with appropriate BLH species. The vegetative plantings on 438 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 1,602 acres in both the primary and secondary impact areas (Figure 3.4), creating approximately 679 AAHUs of freshwater swamp. Restored hydrologic connections would increase the nutrient and sediment loads to 646 acres within the primary impact area. Additional indirect impacts would include increased acreage of swamp wetland vegetation habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements; increased vegetation growth and productivity; and reduced inter- and intra- specific competition between resident and migratory fish and wildlife species for limited coastal swamp wetland vegetation resources. Compared to the No-Action Alternative, implementing this alternative would prevent the conversion of 1,602 acres of existing swamp wetland vegetation habitats to marsh and shallow open water habitats. Increased connectivity for water flow, nutrients, and sediments will benefit the freshwater swamp, even in the event of permanent inundation. Low oxygen and reducing conditions restrict tree growth in inundated conditions. Improved flow would increase oxygen and improve tree vigor, even in fully inundated conditions (Gary Shaffer, personal communication, October 2009).

Cumulative. Alternative 33 (Recommended Plan) would restore approximately 1,602 acres with a total of 679 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes. The impacts to wetland vegetation resources within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.2.3 Alternative 34

Direct. Direct impacts would include the conversion of approximately 18.8 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.10). Approximately 10.5 acres would be converted to conveyance channel, 2.7 acres would be converted to dredged material placement berm habitat, and 5.6 acres would be temporarily impacted by the construction. The acreages associated with direct impacts are found in Table 3.5. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms would be planted with appropriate BLH species. The vegetative plantings on 487 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 1,459 acres in both the primary and secondary impact areas (Figure 3.10), creating approximately 589 AAHUs of freshwater swamp. Restored hydrologic connections would increase the nutrient and sediment loads to 426 acres within the primary impact area.

Cumulative. Alternative 34 would restore approximately 1,459 acres with a total of 589 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.2.4 Alternative 35

Direct. Direct impacts would include the conversion of approximately 13.3 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.11). Approximately 7.2 acres would be converted to conveyance channel, 2.2 acres would be converted to dredged material placement berm habitat, and 3.9 acres would be temporarily impacted by the construction. The acreages associated with direct impacts are found in Table 3.5. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms would be planted with appropriate BLH species. There would be no vegetative plantings.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 820 acres in both the primary and secondary impact areas (Figure 3.11), creating approximately 334 AAHUs of freshwater swamp. Restored hydrologic connections would increase the nutrient and sediment loads to 443 acres within the primary impact area.

Cumulative. Alternative 35 would restore approximately 820 acres with a total of 334 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.2.5 Alternative 36

Direct. Direct impacts would include the conversion of approximately 50.0 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.12). Approximately 29.1 acres would be converted to conveyance channel, 7.8 acres would be converted to dredged material placement berm habitat, and 13.1 acres would be temporarily impacted by the construction. The acreages associated with direct impacts are found in Table 3.5. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms

would be planted with appropriate BLH species. The vegetative plantings on 925 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 3,061 acres in both the primary and secondary impact areas (Figure 3.12), creating approximately 1,268 AAHUs. Restored hydrologic connections would increase the nutrient and sediment loads to 1,072 acres within the primary impact area.

Cumulative. Alternative 36 would restore approximately 3,061 acres with a total of 1,268 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.2.6 Alternative 37

Direct. Direct impacts would include the conversion of approximately 32.1 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.13). Approximately 17.7 acres would be converted to conveyance channel, 4.9 acres would be converted to dredged material placement berm habitat, and 9.5 acres would be temporarily impacted by the construction. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms would be planted with appropriate BLH species. The vegetative plantings on 487 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 2,279 acres in both the primary and secondary impact areas (Figure 3.13), creating approximately 922 AAHUs of freshwater swamp. Restored hydrologic connections would increase the nutrient and sediment loads to 869 acres within the primary impact area.

Cumulative. Alternative 37 would restore approximately 2,279 acres with a total of 922 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.2.7 Alternative 38

Direct. Direct impacts would include the conversion of approximately 44.5 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH

habitat (Figure 3.14). Approximately 25.8 acres would be converted to conveyance channel, 7.2 acres would be converted to dredged material placement berm habitat, and 11.5 acres would be temporarily impacted by the construction. The acreages associated with direct impacts are found in Table 3.5. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms would be planted with appropriate BLH species. The vegetative plantings on 438 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 2,422 acres in both the primary and secondary impact areas, creating approximately 1.013 AAHUs of freshwater swamp (Figure 3.14). Restored hydrologic connections would increase the nutrient and sediment loads to 1,088 acres within the primary impact area.

Cumulative. Alternative 38 would restore approximately 2,422 acres with a total of 1,013 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.2.8 Alternative 39

Direct. Direct impacts would include the conversion of approximately 63.3 acres of existing cypress/tupelo swamp and dredged material berm habitat vegetated by upland plants to open water conveyance channel habitat and BLH habitat (Figure 3.15). Approximately 36.3 acres would be converted to conveyance channel, 9.9 acres would be converted to dredged material placement berm habitat, and 17.1 acres would be temporarily impacted by the construction. The acreages associated with direct impacts are found in Table 3.5. Temporary work areas would be replanted with freshwater swamp species, and the dredged material berms would be planted with appropriate BLH species. The vegetative plantings on 925 acres would be conducted by hand and would have no significant direct impacts on existing wetland vegetation, but would contribute to the improved health of the freshwater swamp system.

Indirect. This alternative would improve the hydrologic connectivity between the ARDC and 3,881 acres in both the primary and secondary impact areas (Figure 3.15), creating approximately 1,602 AAHUs of freshwater swamp. Restored hydrologic connections would increase the nutrient and sediment loads to 1,515 acres within the primary impact area.

Cumulative. Alternative 39 would restore approximately 3,881 acres with a total of 1,602 AAHUs compared to the No-Action Alternative. However, throughout the region, state and nation, the continued deterioration and loss of wetland vegetation resources would likely continue due to natural and human-induced processes.

5.6.3 Upland Vegetation Resources

5.6.3.1 No-Action Alternative

Direct. There would be no direct impacts to upland vegetation.

Indirect. The significant amount of upland vegetation existing in the study area is on the existing spoil bank and would likely remain even as the surrounding swamp converts to open water. Therefore there would be no indirect impact to the No-Action alternative.

Cumulative. The significant amount of upland vegetation existing in the study area is on the existing spoil bank and would likely remain even as the surrounding swamp converts to open water. Therefore there would be no cumulative effect with the No-Action alternative.

5.6.3.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to upland vegetation would result from the construction activities associated with the dredging of new conveyance channels through the existing dredged material berm, as well as the placement of dredged material to create upland islands along these conveyance channels. Approximately 0.8 acre of existing berm would be permanently impacted to create part of the conveyance channel, while approximately 1.8 acres would be temporarily impacted for the construction of cuts through existing berms. The acreages associated with direct impacts are found in Table 3.5. Vegetative plantings under this alternative would encompass 5.0 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation as a result of Alternative 33 (Recommended Plan) are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** The impacts to upland vegetation resources within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.3.3 Alternative 34

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan). Alternative 34 would permanently impact approximately 0.9 acre of upland habitat for the construction of the conveyance channels. In addition, approximately 2.5 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. Vegetative plantings under this alternative would encompass 2.7 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered during construction.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.3.4 Alternative 35

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan). Alternative 35 would permanently impact approximately 0.6 acre of upland habitat for the construction of the conveyance channels. In addition, approximately 1.8 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. The acreages associated with direct impacts are found in Table 3.5. Vegetative plantings under this alternative would encompass 2.2 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.3.5 Alternative 36

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan). Alternative 36 would permanently impact approximately 1.7 acres of upland habitat for the construction of the conveyance channels. In addition, approximately 4.3 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. The acreages associated with direct impacts are found in Table 3.5. Vegetative plantings under this alternative would encompass 7.8 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.3.6 Alternative 37

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan). Alternative 37 would permanently impact approximately 1.5 acres of upland habitat for the construction of the conveyance channels. In

addition, approximately 4.3 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. The acreages associated with direct impacts are found in Table 3.5. Vegetative plantings under this alternative would encompass 4.9 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.3.7 Alternative 38

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan), with the following exceptions. Alternative 38 would permanently impact approximately 1.4 acre of upland habitat for the construction of the conveyance channels. The acreages associated with direct impacts are found in Table 3.5. In addition, approximately 3.6 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. Vegetative plantings under this alternative would encompass 7.2 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation as a result of Alternative 38 are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.3.8 Alternative 39

Direct. The direct impact of this alternative would be similar to Alternative 33 (Recommended Plan). Alternative 39 would permanently impact approximately 2.3 acres of upland habitat for the construction of the conveyance channels. In addition, approximately 6.1 acres of existing berm would be temporarily impacted for the construction of cuts in existing berms. The acreages associated with direct impacts are found in Table 3.5. Vegetative plantings under this alternative would encompass 9.9 acres of newly created upland habitat.

Indirect. No indirect impacts to upland vegetation are expected. Existing upland communities within the areas of impact are stable and would not be significantly altered during construction.

Cumulative. Changes to cumulative impacts within existing upland vegetation would be minimal for this alternative**.** Overall cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.4 Submerged Aquatic Vegetation (SAV)

5.6.4.1 No-Action Alternative

Direct. There would be no direct impacts to the SAV community.

Indirect. The submerged aquatic community would continue to change as the swamp changes to marsh and open water.

Cumulative. Cumulative impacts would be the effects from wetland loss and degradation throughout coastal Louisiana. However, the impacts to SAV within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.4.2 Alternative 33 (Recommended Plan)

Direct. Alternative 33 (Recommended Plan) would directly impact any SAV communities along the ARDC by mechanical crushing during construction. These impacts would be temporary and the vegetative community would quickly rebound. Most SAV communities would receive no direct impact as a result of proposed management activities.

Indirect. Cutting through existing berms and creating conveyance channels would indirectly affect SAV habitat by creating additional habitat.

Cumulative. Cumulative impacts would be the effects from wetland loss and degradation throughout coastal Louisiana. The impacts to SAV within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.4.3 Alternatives 34-39

Direct. The direct impact would be similar to Alternative 33 (Recommended Plan).

Indirect. The indirect impact would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.6.5 Invasive Species Vegetation

5.6.5.1 No-Action Alternative

Direct. There would be no direct impacts to invasive vegetation.

Indirect. Invasive species would continue to spread, as the swamp converts to marsh and open water.

Cumulative. Invasive vegetation would continue to increase, as it would in south Louisiana, the region, and the country. However, the impacts to invasive

vegetation species within the study area and vicinity would be offset to some extent by other Federal, state, local, and private invasive species control efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.5.2 Alternative 33 (Recommended Plan)

Direct. Invasive vegetation within the construction zones may be negatively affected by construction activities by direct removal, crushing or burial. In all three cases, these impacts are expected to be temporary and the remaining plants would likely regenerate quickly in the disturbed areas of the study area.

Indirect. Restored connectivity and the planting of native vegetation would somewhat reduce the proliferation of invasive species.

Cumulative. Invasive species would continue to proliferate within the study area and Alternative 33 (Recommended Plan) would help to reduce this spread because of the restored connectivity and planting of native vegetation. The invasive species spread in the study area would be additive with the invasive species spread throughout coastal Louisiana and the Nation. The positive impacts to invasive vegetation species within the study area and vicinity would be additive to some extent with other Federal, state, local, and private invasive species control efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.6.5.3 Alternatives 34-39

Direct. The direct impact would be similar to Alternative 33 (Recommended Plan).

Indirect. The indirect impact would be similar to Alternative 33 (Recommended Plan).

Cumulative. The cumulative impact would be similar to Alternative 33 (Recommended Plan).

5.7 WILDLIFE HABITAT

5.7.1 No-Action Alternative

Direct. There would be no direct impacts to wildlife resources.

Indirect. Adverse indirect impacts on wildlife resources would result from the continued conversion of 18,204 acres of primarily swamp habitat to marsh and shallow open water habitats. Swamp areas used for foraging, nesting, and over-wintering habitat would convert initially to fresh marsh, and ultimately to shallow open water habitat. Swamp habitat quality would continue to decline as the swamp continues to deteriorate. As the swamp areas convert to open water, species richness would likely decline. The loss of swamp habitat and continued degradation would likely result in competition for dwindling swamp resources and a localized decrease in wildlife use of the area and movement of more mobile wildlife to more

suitable areas. With the continued degradation of the swamp and the eventual conversion to open water, feeding opportunities for bald eagles will decline. The loss of freshwater swamp trees will decrease bald eagle nesting habitat. Similarly, nesting trees available for colonial nesting wading bird colonies would also decline.

Cumulative. Cumulative impacts would include the conversion of 18,204 acres of existing swamp habitat to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts locally, regionally, statewide and nationwide. However, these negative impacts to wildlife habitat within the study area and vicinity would be offset to some extent by the positive effects of other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.7.2 Alternative 33 (Recommended Plan)

Direct. Construction activities associated with implementation of Alternative 33 (Recommended Plan) may disrupt or displace wildlife resources. However, any such impacts would be localized and temporary, and most wildlife species would temporarily relocate to nearby areas. No permanent displacement would be expected from restoration activities as wildlife is expected to return when project construction is completed. Conveyance channels would be constructed, providing deepwater habitat in the swamp and allowing exchange of water, nutrients, and sediments between the swamp and the ARDC and creation of habitat for SAV, fish, and wildlife. Upland habitat created by the placement of the dredged material will provide additional refuge for various wildlife species during high water events. As a result of the public review process, the USFWS has requested that a qualified biologist inspect the proposed worksite for the presence of undocumented colonial wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for colonial wading bird nesting colonies and October through mid-May for bald eagles). In addition, it has been recommended by the USFWS that construction activities and/or land clearing be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

Indirect. Indirect impacts to wildlife resources would include the restoration and creation of a net total of 1,602 acres of swamp and bottomland hardwood "island" habitats, with a total of 679 AAHUs that would be utilized by resident and migrant wildlife species for nesting, rearing of young, resting, and foraging activities. Swamp creation/nourishment would also help to increase and preserve important stopover habitat for neotropical migrants as well as wintering habitat for waterfowl. The increase in tree canopy would improve bald eagle and colonial waterbird nesting habitat. In addition, the quality of habitat would be improved, which would increase the abundance of prey items for wildlife.

Cumulative. Cumulative impacts would be the additive effects restoring 1,602 acres of important fish and wildlife in combination with the impacts for overall net acres restored, created, nourished, and protected by other Federal, state, local, and private restoration efforts. The positive impacts to wildlife habitat within

the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.7.3 Alternative 34

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan),
except approximately 1,459 acres of freshwater swamp habitat would be restored and 589 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 34 would restore a net total of 1,459 acres of freshwater swamp habitat with 589 AAHUs compared to the No-Action Alternative.

5.7.4 Alternative 35

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Impacts would be similar to Alternative 33 (Recommended Plan), except approximately 820 acres of freshwater swamp habitat would be restored and 334 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 35 would restore a net total of 820 acres of freshwater swamp habitat with 334 AAHUs compared to the No-Action Alternative.

5.7.5 Alternative 36

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except approximately 3,061 acres of freshwater swamp habitat would be restored and 1,268 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 36 would restore a net total of 3,061 acres of freshwater swamp habitat with 1,268 AAHUs compared to the No-Action Alternative

5.7.6 Alternative 37

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except approximately 2,279 acres of freshwater swamp habitat would be restored and 922 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 37 would restore a net total of 2,279 acres of freshwater swamp habitat with 922 AAHUs compared to the No-Action Alternative.

5.7.7 Alternative 38

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except approximately 2,422 acres of freshwater swamp habitat would be restored and 1,013 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 38 would restore a net total of 2,422 acres of freshwater swamp habitat with 1,013 AAHUs compared to the No-Action Alternative.

5.7.8 Alternative 39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan), except approximately 3,881 acres of freshwater swamp habitat would be restored and 1,602 AAHUs would be created.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan), except Alternative 39 would restore a net total of 3,881 acres of freshwater swamp
habitat with 1,602 AAHUs compared to the No-Action Alternative.

5.8 AQUATIC RESOURCES

5.8.1 Benthic

5.8.1.1 No-Action Alternative

Direct. Under the No-Action Alternative no direct adverse impacts to benthic organisms would occur.

Indirect. Over time, indirect impacts of impoundment, limited hydrologic connections between the interior swamp wetlands and the ARDC, swamp habitat degradation and conversion to open water habitat would continue under the No-Action Alternative. These impacts would indirectly result in a decrease in the

quality of benthic habitat within the study area, thereby reducing the area's ability to support benthic species. The persistence of existing conditions would result in the continued conversion of 18,204 acres of existing swamp habitat to shallow water habitat that would provide additional albeit poor quality benthic habitat. Other indirect impacts would include a decrease of available nutrients and detritus. Habitat quality would likely continue to degrade, creating a stressful environment for those benthic and other aquatic species presently utilizing the area. Some populations of benthic organisms would likely decrease, impacting other species in the food web.

Cumulative. Cumulative impacts of the No-Action Alternative would primarily be related to conversion of 18,204 acres of swamp and associated benthic habitat to a shallow open water system. These impacts to benthic resources would be in addition to other regional and Louisiana coast-wide swamp and benthic habitat losses and degradation. The LCA Near-term Ecosystem Restoration Plan (USACE, 2004) estimated a net loss of 328,000 acres of coastal wetland habitat would occur by 2050. This is nearly 10 percent of Louisiana's remaining coastal wetlands, which are utilized by various benthic species for shelter, foraging, cover, nursery, and other life requirements. Benthic populations within Louisiana in general and the study area in particular would likely continue to shift towards more saline-oriented species as land loss and saltwater intrusion continue to affect Louisiana's interior regions. These adverse cumulative impacts would be offset, to some degree by the positive impacts associated with swamp and benthic habitats restored created, nourished, and protected by other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2).

5.8.1.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to benthic resources would generally be associated with conveyance channel construction activities, including conversion of 0.8 acres of ARDC dredged material berms and 17.8 acres of existing swamp habitat to conveyance channel waterbottoms that would provide potential benthic habitat. Approximately 18.6 acres of benthic habitat would be created by the conveyance channel construction. These actions would directly impact and destroy any slow-moving or sessile benthic organisms found within the proposed excavation and berm creation areas. More mobile benthic species utilizing the area would likely be displaced. Other direct impacts to the benthos would be localized and confined to construction areas. However, the prolific nature of the benthic community is expected to result in rapid re-colonization of substrates once construction is completed. In addition, benthic resources occur seasonally in the swamp and are more abundant during winter months. Therefore, direct effects may vary depending on the time of the year construction occurs.

Indirect. Indirect impacts to benthic resources would be related primarily to disturbance of waterbottoms during placement of dredged material and dredging. Short-term disturbance to benthic species would likely occur from increased

turbidity, temperature, and BOD; and decreased dissolved oxygen due to dredging and dredged material berm creation. Some smothering of benthic organisms may also occur from dredge plume resettlement, but these impacts would be minimized through the use of silt curtains or other construction measures to minimize dredging impacts. Some indirect impacts would be localized and temporary; however, the construction of conveyance channels and the decrease in habitat degradation would alter the benthic community structure. A total of 1,602 acres of swamp habitat would be restored by this alternative. Swamp habitat benefitted by Alternative 33 (Recommended Plan) would indirectly benefit benthic resources by providing increased dissolved organic compounds and detritus that would, in turn, provide food and energy resources for benthic organisms.

Cumulative. Cumulative impacts would be the additive effects of restoring 1,602 acres of primarily swamp habitat resulting in greater resources for benthic organisms due to the export of dissolved organic compounds and detritus from the swamp. The net beneficial impacts would be in combination with the impacts for overall net acres of swamp and benthic habitat restored created, nourished, and protected by other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2).

5.8.1.3 Alternative 34

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 0.9 acre of berm and 9.6 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 10.5 acres of conveyance channel bottoms would be created and approximately 1,459 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.1.4 Alternative 35

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 0.6 acre of berm and 6.6 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 7.2 acres of conveyance channel bottoms would be created and approximately 820 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.1.5 Alternative 36

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 1.7 acres of berm and 27.4 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 29.1 acres of conveyance channel bottoms would be created and approximately 3,061 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.1.6 Alternative 37

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 1.5 acres of berm and 16.2 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 17.7 acres of conveyance channel bottoms would be created and approximately 2,279 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.1.7 Alternative 38

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 1.4 acres of berm and 24.4 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 25.8 acres of conveyance channel bottoms would be created and approximately 2,420 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.1.8 Alternative 39

Direct. Direct impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan), except approximately 2.3 acres of berm and 34 acres of swamp will be converted to conveyance channel.

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan), except 36.3 acres of conveyance channel bottoms would be created and approximately 3,881 acres of freshwater swamp would be benefited.

Cumulative. Cumulative effects of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.8.2 Plankton

5.8.2.1 No-Action Alternative

Direct. There would be no direct adverse impacts to plankton resources.

Indirect. Adverse indirect impacts would result from the continued conversion of swamp habitat, initially to fresh marsh, and ultimately to open water. The projected habitat conversion would ultimately create unstable environment for plankton resources.

Cumulative. Algal blooms would continue in the open waters within the swamp as a result of the release of phosphorus sequestered in swamp sediments into surface waters. Within coastal areas of Louisiana, plankton populations are experiencing a shift towards more saline-oriented species as land loss and saltwater intrusion continues. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to plankton resources throughout the region and state (see Figure 5.1 and Table 5.2).

5.8.2.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts to plankton resources would generally be associated with construction activities. Some species could suffer mortality or injury during dredging and placement of borrow material. Construction activities would negatively impact plankton populations by temporarily increase turbidity, temperatures, and BOD; and decrease DO.

Indirect. Construction would create conveyance channels, providing deepwater habitat in the swamp. The negative increases in turbidity and temperature and a decrease in DO associated with these actions would be temporary and localized. These conveyance channels would allow plankton access into the interior swamp and create a more normal nutrient exchange between the swamp and outside waters. Increased productivity, as a result of the 1,602 acres of swamp habitat benefited by this alternative, would provide indirect benefits to plankton by increasing nutrients and detritus.

Cumulative. Plankton resources would continue to be adversely impacted by the coastal land loss and swamp degradation.

5.8.2.3 Alternatives 34-39

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to those described for Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to those described for Alternative 33 (Recommended Plan).

5.9 FISHERY RESOURCES

5.9.1 No-Action Alternative

Direct. There would be no direct impacts to fishery resources.

Indirect. Over time, indirect impacts of impoundment, limited hydrologic connections between the interior swamp wetlands and the ARDC, swamp habitat degradation, and conversion to open water would continue. These impacts would indirectly result in a decrease in the quality of aquatic habitat within the study area, thereby reducing the area's ability to support fishery organisms. Some populations of aquatic organisms would likely decrease, impacting other species in the food web. The reduction in swamp wetlands habitat would also result in shifts in predator/prey relationships as well as a potential decline in fishery productivity. Recreational fishing opportunities would continue to be limited. Ingress and egress access of fishery organisms to interior portions of the swamp would continue to be limited due to dredged material berms along ARDC which block access. Swamp habitat used by fishery organisms for shelter, nesting, feeding, cover, nursery, and other life history requirements would continue to degrade and convert to shallow open water habitat. Although the continued conversion of swamp habitat to open water habitat would increase the amount of aquatic habitat available to fishery resources, the quality of the aquatic habitat would likely continue to degrade, creating a lower quality environment for fishery and other aquatic species.

Cumulative. Cumulative impacts of the No-Action Alternative would primarily be related to the conversion of 18,204 acres of swamp habitat to a shallow open water system. These impacts would be in addition to other Louisiana coast-wide fishery habitat losses and degradation, as well as the impacts of other state and Federal projects in the vicinity (see Figure 5.1 and Table 5.2). The LCA Near-term Ecosystem Restoration Plan (USACE, 2004) estimated a net loss of 328,000 acres of coastal wetland habitat would occur by 2050. This is nearly 10 percent of Louisiana's remaining coastal wetlands, which are utilized by various fish species for shelter, foraging, cover, nursery, and other life requirements. However, fishery populations within Louisiana in general and the study area in particular would likely continue to shift towards more saline-oriented species as land loss and saltwater intrusion continue to affect Louisiana's interior regions.

5.9.2 Alternative 33 (Recommended Plan)

Direct. Direct impacts of implementing Alternative 33 (Recommended Plan) on fishery organisms would generally be associated with construction activities, including creation of 16,010 linear feet long of conveyance channel habitat. Additional direct impacts would be the creation of 18.6 acres conveyance channel habitat. Any sessile or slow moving fisheries species present could suffer mortality or injury during the dredging and placement of borrow material. Construction activities would temporarily increase turbidity, temperatures, and BOD; and decrease DO. These temporary conditions could displace more mobile fisheries species from the construction area. Following construction, displaced fisheries species would likely return to the areas of impact. Overall, the direct impacts to fishery resources are temporary and minor.

Indirect. Indirect impacts include the increased productivity, as a result of hydrologic restoration of 1,602 acres of swamp habitat, and would provide an increase in the energy inputs into the local food web. Sediment and nutrient transport into the interior swamp areas would improve fishery productivity. Increasing the health of the study area swamp and bottomland hardwood habitat would support not only local fishery resources but would also contribute to increasing the flow of detritus and other important components of the aquatic food web from the interior wetland habitats to estuarine areas closer to the Gulf of Mexico.

Cumulative. Cumulative impacts would be the additive effect of restoring 1,602 acres of primarily cypress/tupelo swamp habitat, with the combination of impacts and benefits for the overall net acres benefitted by other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Swamp restoration and reconnected hydrology would result in greater resources for aquatic and fishery resources due to the increased export of dissolved organic compounds and detritus from wetlands.

5.9.3 Alternative 34

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 34 would create 8,483 linear feet of conveyance channel habitat for at total of 10.5 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.9.4 Alternative 35

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 35 would create 5,930 linear feet of conveyance channel habitat for at total of 7.2 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.9.5 Alternative 36

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 36 would create 24,493 linear feet of conveyance channel habitat for at total of 29.1 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.9.6 Alternative 37

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 36 would create 14,413 linear feet of conveyance channel habitat for at total of 17.7 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.9.7 Alternative 38

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 38 would create 21,940 linear feet of conveyance channel habitat for at total of 25.8 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.9.8 Alternative 39

Direct. Direct impacts would be similar to those described for Alternative 33 (Recommended Plan), except Alternative 39 would create 30,423 linear feet of conveyance channel habitat for at total of 36.3 acres of deepwater aquatic habitat.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts of this alternative would be similar to those described for Alternative 33 (Recommended Plan).

5.10 ESSENTIAL FISH HABITAT (EFH)

5.10.1 No-Action Alternative

Direct. There would be no direct impacts to EFH.

Indirect. There is no EFH in the study area and there would be no indirect impacts.

Cumulative. Cumulative impacts would be the additive combination of similar impacts from wetland loss and degradation throughout coastal Louisiana, as well as the benefits and impacts of other state and Federal projects in the vicinity (see Figure 5.1 and Table 5.2).

5.10.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to EFH.

Indirect. There would be no indirect impacts to EFH.

Cumulative. There would be no cumulative impacts to EFH.

5.10.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.11 THREATENED AND ENDANGERED SPECIES

5.11.1 No-Action Alternative

Direct. There would be no direct effects on threatened and endangered species or their habitat.

Indirect. General habitat loss for the study area would continue. Important nesting, feeding, roosting, and nursery habitat within the study area would continue to erode and convert to shallow open water

Cumulative. There would be a continued degradation and loss of fish and wildlife habitat for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements in coastal Louisiana. Cumulative impacts would be the additive combination of similar impacts from wetland loss and degradation throughout coastal Louisiana, as well as, the benefits and impacts of other state and Federal projects in the vicinity (see Figure 5.1 and Table 5.2).

5.11.2 Alternative 33 (Recommended Plan)

Direct. There is no critical habitat for the Gulf sturgeon in the study area. The proposed action would not jeopardize the continued existence of the Gulf sturgeon. Hence, the USACE has determined the proposed action is Not Likely to Adversely Affect (NLAA) Gulf sturgeon or its critical habitat. Appendix A presents a Biological Assessment that describes those factors used in determining the potential impacts of the proposed action on the Gulf sturgeon.

Any effects to the West Indian manatee from implementing the proposed action would be related to possible collision with service vessels during the construction activities. All USACE personnel and all contractors would be informed of the need to abide by the following procedures to avoid and minimize any impacts to the manatees.

Special Operating Conditions If Manatees Are Present in the Project Area:
(1) If a manatee(s) is sighted within 100 yards (91 m) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 ft (15.2 m) of a manatee. If a manatee is closer than 50 ft (15.2 m) to moving equipment or the project area, the equipment will be shut down and all construction activities will cease to ensure protection of the manatee.

Construction activities will not resume until the manatee has departed and the 50-foot (15.2 m) buffer has been re-established.

(2) If a manatee(s) is sighted in the project area, all vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot (1.2 m) clearance from the bottom, and vessels will follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits.

(3) If siltation barriers are used, they will be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment.

(4) Manatee Signs. Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign

at least 8-1/2" x 11" (21.6 x 27.9 cm) reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' (0.9 x 1.2 m) sign reading "CAUTION: MANATEE AREA" will be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2" x 11" (21.6 x 27.9 cm) reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUT DOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" will be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction.

Given the rare occurrence of manatees within the areas of impact, along with the implementation of the above operational precautions, no collision fatalities are expected.

Indirect. There would be no adverse indirect impacts of implementing Alternative 33 (Recommended Plan) to any listed species. Rather, proposed marsh nourishment would provide a net increase of transitional coastal wetland habitat by increasing the quality of habitat; increasing species usage and diversity; and providing for a net increase in habitats used for forage, breeding, spawning, and cover. The increase in wetland acreage would provide increased detritus that would be exported to ARDC water bottoms, thereby providing additional resources for the benthic food chain that would in turn increase the availability of prey items for Gulf sturgeon.

Indirect impacts to listed species would primarily be positive resulting from the wetland nourishment features, which would provide a net creation and nourishment of 1,602 acres of transitional swamp, compared to the No-Action Alternative. However, there may be some temporary and localized minor effects on the food supply for Gulf sturgeon as some of the ARDC water bottom would be dredged to construct the conveyance channels. Any such impacts to the benthic food supply are anticipated to be minor, as only a small fraction of the total ARDC water bottom would be impacted, and the benthos would re-colonize dredged locations rapidly following construction. There is no critical habitat for Gulf sturgeon in the study area.

Cumulative. Cumulative impacts would be the additive effect with the combination of impacts and benefits for overall net acres created and nourished by other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Alternative 33 (Recommended Plan) would create and nourish a net total of 1,602 acres of freshwater swamp. Although unlikely to impact populations on a continental scale, those listed species that utilize the areas of impact would also benefit from the cumulative effects of Alternative 33 (Recommended Plan) and other restoration efforts in the area.

5.11.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.12 CULTURAL AND HISTORIC RESOURCES

5.12.1 No-Action Alternative

Direct. There would be no direct impacts on historic and cultural resources.

Indirect. The eventual land loss within the study threatens the existence and integrity of all cultural resources found within the study area.

Cumulative. Within the country and coastal Louisiana, the institutional recognition of all cultural resources as a significant resource would likely continue, along with their potential loss due to natural and human causes. The land loss within the study area and throughout coastal Louisiana threatens the existence and integrity of these resources. However, the impacts to cultural resources within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts preventing coastal erosion and protecting cultural resources across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.12.2 Alternative 33 (Recommended Plan)

Direct. Alternative 33 (Recommended Plan), would have no direct impacts on historic and cultural resources as there are no National Register of Historic Places (NRHP) eligible or listed sites within the project area. Measures (see the Programmatic Agreement located in Appendix F) would be put into place in the case that any cultural resources are discovered during construction.

Indirect. Ecosystem restoration measures would prevent further land loss and erosion in the areas of impact. This would benefit cultural and historic resources in the study area by preventing the erosion that threatens their existence.

Cumulative. Cumulative impacts of the proposed action are related to the increased stability of the wetland resources throughout the region. The reduction in land loss and subsequent preservation of cultural resources within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts preventing coastal erosion and protecting cultural resources across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.12.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.13 AESTHETICS

5.13.1 No-Action Alternative

Direct. There would be no direct beneficial or adverse impacts to aesthetic resources.

Indirect. Conversion of existing bald cypress-tupelo swamp to fresh marsh and ultimately to open water habitat would continue, possibly resulting in degraded viewscapes for those traveling within the study area (along the ARDC). Habitat degradation and conversion under the No-Action Alternative would also likely impair the viewshed of the Blind River, a designated Scenic River.

Cumulative. Cumulative impacts would be the continued aesthetic losses associated with the degradation of freshwater swamps throughout coastal Louisiana, with the additive combination of similar impacts from wetland loss and degradation throughout coastal Louisiana.

5.13.2 Alternative 33 (Recommended Plan)

Direct. Viewscapes would be minimally and temporarily disturbed by construction activities. The immediate effects of construction activities, such as grading and clearing of vegetation, would temporarily reduce the aesthetic value of sections of the study area. Initially some of the study area would become unvegetated. These minor impacts would be localized and temporary. The areas of impact should quickly stabilize, and the newly created, nourished, and protected wetlands would provide new high quality viewscapes as well as protect existing ones. Plantings, along with existing wetland vegetation, would recolonize the area, thereby increasing the scenic value of the areas of impact and surroundings through increased visual complexity.

Indirect. The indirect impacts would primarily result from newly created high quality emergent wetlands that would provide long term visual enhancement of an area that is presently experiencing a decline in visual complexity.

Cumulative. The continued degradation of coastal Louisiana would lead to degraded aesthetic resources. The implementation of Alternative 33 (Recommended Plan) would have a positive cumulative impact. The impact to aesthetics within the study area and vicinity would be additive to some extent with other Federal, state,

local, and private restoration effects across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.13.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.14 RECREATION

5.14.1 No-Action Alternative

Direct. There would be no direct effect on recreation within the study area.

Indirect. There would be a continued loss and degradation of habitat in the study area resulting in lost recreational opportunities, including fishing, wildlife viewing, and hunting.

Cumulative. There would be a continued loss in Coastal Louisiana of habitat resulting in lost recreational opportunities. The impacts to recreation resources within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.14.2 Alternative 33 (Recommended Plan)

Direct. There would be minor, temporary, direct impacts to recreation. Recreational boaters would have to slow and avoid some of the marine equipment during construction.

Indirect. This alternative would have little effect on the level of boating activity. The cuts in the dredged material berms of the ARDC and the conveyance channels reaching into the interior of the swamps would provide spawning opportunities for species of recreational importance. However, the improvement to fisheries would be minimal and would not affect the level of fishing activity. Alternative 33 (Recommended Plan) would have a minor positive effect on the quality of hunting because of improvements to the aesthetics of the swamp and an increase in the quality of the deer. However, the quantification of value is minor because little hunting is done in the area that would be affected by the alternative. There may be a minimal change in the level of hunting activity in the study area. Hunting is limited to leaseholders and is not available to the general public.

Cumulative. The annual value of recreation would not increase to any measurable extent under Alternative 33 (Recommended Plan). Approximately 1,602 acres of important stopover habitat (freshwater swamp) would be improved

for migratory neotropical songbirds and waterfowl. The net positive impacts to recreation resources within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.14.3 Alternatives 33-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15 SOCIOECONOMIC AND HUMAN RESOURCES

5.15.1 Population and Housing

5.15.1.1 No-Action Alternative

Direct. There would be no direct impact on population and housing in the study area.

Indirect. There would be little to no indirect effect on population and housing within the study area.

Cumulative. Populations within Ascension and Livingston Parishes would continue their projected increases. The study area is not located in a highly populated area. The impacts to population and housing within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.1.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts on population and housing within the study area.

Indirect. There would be little to no indirect effect on population and housing within the study area.

Cumulative. Populations within Ascension and Livingston Parishes would continue their projected increases. The study area is not located in a highly populated area; therefore, swamp nourishment and creation activities would likely have no beneficial or adverse effects on population and housing. The impacts to population and housing within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.1.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.2 Employment and Income

5.15.2.1 No-Action Alternative

Direct. There would be no direct effect on employment and income.

Indirect. There would be no indirect effect on employment and income.

Cumulative. Employment and income level would continue to increase or decline in coastal Louisiana according to the national and regional economic health. The impacts to employment and income within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.2.2 Alternative 33 (Recommended Plan)

Direct. There would be a minor positive effect on temporary jobs and income as a result on the implementation of Alternative 33 (Recommended Plan).

Indirect. There would be a temporary and minor positive effect on services (goods, fuel, food, equipment rentals, etc.) from construction expenses related to implementation of Alternative 33 (Recommended Plan).

Cumulative. There would be very little change in the cumulative effects. Employment and income level would continue to increase or decline in coastal Louisiana according to the national and regional economic health. The impacts to employment and income within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.2.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.3 Community Cohesion

5.15.3.1 No-Action Alternative

Direct. The No-Action Alternative would have no beneficial or adverse direct impacts on community cohesion within the study area.

Indirect. The No-Action Alternative would have no beneficial or adverse indirect impacts on community cohesion within the study area.

Cumulative. Cumulative impacts would be the additive combination of similar impacts from wetland loss and degradation throughout coastal Louisiana. Assuming existing proposed permits were completed, several of the current subdivisions would expand, and a proposed bridge over the ARDC would improve community cohesion. The impacts to community cohesion within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.3.2 Alternative 33 (Recommended Plan)

Direct. Alternative 33 (Recommended Plan) would have no beneficial or adverse direct impacts on community cohesion within the study area.

Indirect. Alternative 33 (Recommended Plan) would have no beneficial or adverse indirect impacts on community cohesion within the study area.

Cumulative. There would be no effect on the cumulative impacts on community cohesion. The impacts to community cohesion within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.3.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.4 Environmental Justice

5.15.4.1 The No-Action Alternative

Direct. No minority and/or low-income communities have been identified in the study area that would be adversely impacted by the No-Action Alternative. Therefore, no disproportionately high or adverse human health or environmental effects on minority or low-income populations would occur.

Indirect. General habitat loss for the study area would continue; however, no disproportionately high or adverse human health or environmental indirect impacts on minority or low-income populations would occur as there are none identified within the study area.

Cumulative. There would be no cumulative impacts on minority and/or low-income communities, as none have been identified within the study area per 2000 U.S. Census information and requirements of Executive Order (E.O.) 12898. Increasing populations worldwide. Increasing opportunity for the development of minority communities and the expansion of low-income populations worldwide.

5.15.4.2 Alternative 33 (Recommended Plan)

Direct. No direct impacts on human health or environmental effects within the study area would occur with the implementation of Alternative 33 (Recommended Plan).

Indirect. No indirect impacts on human health or environmental effects within the study area would occur with the implementation of Alternative 33 (Recommended Plan).

Cumulative. There would be no adverse cumulative impacts on minority and/or low-income communities as none have been identified within the study area per 2000 U.S. Census information and requirements of E.O. 12898. Environmental justice issues are unlikely to occur when combined with other Federal, state, local, and private restoration efforts.

5.15.4.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.5 Infrastructure

5.15.5.1 No-Action Alternative

Direct. There would be no direct impacts to infrastructure.

Indirect. Existing and future infrastructure present within the study area would be indirectly affected due to the land loss created from the deterioration and conversion of existing swamp habitat to shallow open water habitat.

Cumulative. Cumulative effects would continue as land loss would increase erosion on infrastructure, similar to impacts from wetland loss and degradation throughout coastal Louisiana. Conversion of swamp vegetation to fresh marsh or

open water habitat may affect relocations and maintenance of infrastructure within the study area.

5.15.5.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct effect on infrastructure.

Indirect. Existing and future infrastructure present within the study area would be indirectly benefitted. Restoration and preservation of the swamp system would support the sustainability of existing infrastructure by reducing inundation, wave action, and erosion.

Cumulative. Cumulative impacts would be the beneficial effects of restoration which supports infrastructure with other coastal restoration protection projects. This alternative would have positive effects on infrastructure when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There would be a reduced level of infrastructure damages and relocations compared to the No-Action Alternative.

5.15.5.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.6 Business and Industry

5.15.6.1 No-Action Alternative

Direct. There would be no direct impacts on business and industry.

Indirect. There would be no indirect impacts to business and industry.

Cumulative. Continued population growth and supporting business and industry development contributes to degradation and loss of coastal and other wetlands. Degradation and loss of wetlands would contribute to potential losses of businesses.

5.15.6.2 Alternative 33 (Recommended Plan)

Direct. There would be minor direct benefits due to the temporary jobs and services required for the construction and monitoring of Alternative 33 (Recommended Plan).

Indirect. There would be minor indirect benefits related to the continued support of business and industry by reducing the degradation and loss of wetlands that could contribute to the potential losses of businesses.

Cumulative. Cumulative impacts would continue to be controlled primarily by the national and regional economy. This alternative would have little effects on business and industry when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). The study area does not appear to provide many opportunities for future business growth.

5.15.6.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.7 Traffic and Transportation

5.15.7.1 No-Action Alternative

Direct. There would be no direct impacts to traffic and transportation, including highways or golf cart paths within the study area.

Indirect. Wetland land loss threatens the stability of roads passing through the area, resulting in increased maintenance.

Cumulative. Wetland land loss threatens the stability of roads passing through the area, resulting in increased maintenance. Assuming existing permitted projects are completed, several of the current subdivisions would expand, creating additional roads, bridges, and traffic.

5.15.7.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts on traffic and transportation.

Indirect. This alternative would have little effect on traffic and transportation. There would be a reduced level of road damages and relocations due to wetland loss.

Cumulative. This alternative would have little effect on traffic and transportation when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There would be a reduced level of road damages and relocations due to wetland loss.

5.15.7.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.8 Public Facilities and Services

5.15.8.1 No-Action Alternative

Direct. There would be no direct impacts on public facilities and services, such as sewerage, wastewater treatment, or electrical facilities.

Indirect. Wetland land loss potentially threatens public facilities and services and increases maintenance.

Cumulative. Wetland land loss potentially threatens public facilities and services and increases maintenance. Several of the current subdivisions would expand, creating additional needs for public facilities and services.

5.15.8.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts on public facilities and services.

Indirect. This alternative would have little effect on public facilities and services. There would be a reduced level of damages and relocations of public facilities and services and increased maintenance due to wetland loss.

Cumulative. This alternative would have little effect on public facilities and services when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There would be a reduced level of public facilities and services damages and relocations due to wetland loss.

5.15.8.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.9 Local Government Finance

5.15.9.1 No-Action Alternative

Direct. There would be no direct impacts on local government finance, since there are no incorporated towns within the study area.

Indirect. Increasing population growth would increase the funding for local government.

Cumulative. There is no potential for new town development, and none would be developed in the future. Expansion of the current subdivisions would increase the tax base, thus increasing local government finances.

5.15.9.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts on local government finance.

Indirect. There would be no indirect impacts on local government finance.

Cumulative. Cumulative impacts would continue as controlled by the local population. This alternative would have little effect on local government finances when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There is no potential for new town development within or contiguous to the area impacted by this alternative, and none would be developed in the future. Expansion of the current subdivisions would increase the tax base, thus increasing local government finances.

5.15.9.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.10 Tax Revenue and Property Values

5.15.10.1 No-Action Alternative

Direct. There would be no direct impacts on tax revenue and property values.

Indirect. Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions. At the same time, property values may drop from lowering aesthetics due to swamp degradation.

Cumulative. Cumulative impacts would continue as controlled by the local population growth and tax base.

5.15.10.2 Alternative 33 (Recommended Plan)

Direct. There would be minor direct increases in tax revenue due to the goods and services required for the construction and monitoring associated with the implementation of Alternative 33 (Recommended Plan). There would be little to no direct effects on overall property values within the study area.

Indirect. Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions as well as due to increased aesthetics. Minor indirect increases in tax revenue due to the goods and services associated with the construction of Alternative 33 (Recommended Plan) and the preservation and improvement due to the project.

Cumulative. Cumulative effects would continue as controlled by the national and regional economy. This alternative would have little effect on tax revenue and property values when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions as well as due to increased aesthetics.

5.15.10.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.11 Community and Regional Growth

5.15.11.1 No-Action Alternative

Direct. There would be no direct impacts on community and regional growth.

Indirect. There would be little indirect impacts on community and regional growth. Little additional infilling would occur in Berthelot's Campground, Waterfront East, and Three Rivers Island since those communities are nearly fully developed or fully inhabited. Assuming the existing permitted projects are constructed, additional growth would occur with the extension of the Three Rivers Island campsites to the east and the establishment of Waterfront East-Sanctuary South. These projects would continue to contribute to the growth of the southern portion of Livingston Parish. After these developments are completed, the

possibilities of the study area would have been largely exhausted because of the lack of developable land.

Cumulative. Minor additional increases in community and regional growth would be sustained through the infilling of lots in the existing and proposed subdivisions. Cumulative effects would continue to be controlled by the national, regional, and local economy.

5.15.11.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts on community and regional growth due to the implementation of Alternative 33 (Recommended Plan).

Indirect. There would be little indirect impacts on community and regional growth due to the implementation of Alternative 33 (Recommended Plan). Little additional infilling would occur in Berthelot's Campground, Waterfront East, and Three Rivers Island since those communities are nearly fully developed or fully inhabited. Assuming the existing permitted projects are constructed, additional growth would occur with the extension of the Three Rivers Island campsites to the east and the establishment of Waterfront East-Sanctuary South. These projects would continue to contribute to the growth of the southern portion of Livingston Parish. After these developments are completed, the possibilities of the study area would have been largely exhausted because of the lack of developable land.

Cumulative. This alternative would have little effect on community and regional growth when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Additional increases in community and regional growth would be sustained through the filling of lots in the existing and proposed subdivisions.

5.15.11.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.12 Land Use Socioeconomics

5.15.12.1 Agriculture

5.15.12.1.1 No-Action Alternative

Direct. There would be no direct impacts to agriculture or pasture acreage since no such acreage is present within the study area.

Indirect. There would be no indirect impacts to agriculture or pasture acreage.

Cumulative. Cumulative effects on agriculture would continue to be controlled by the national, regional, and local economy. Agricultural lands, primarily livestock pastures, within the study area would continue to be used and may be adversely impacted by habitat conversion and land loss.

5.15.12.1.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to agriculture or pasture acreage since no such acreage is present within the study area.

Indirect. There would be no indirect impacts to agriculture or pasture acreage.

Cumulative. This alternative would have positive effects on agriculture when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). There would be a reduced level of agriculture land habitat conversion and land loss compared to the No-Action Alternative.

5.15.12.1.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.12.2 Forestry

5.15.12.2.1 No-Action Alternative

Direct. There would be no direct effects to forestry, including timber harvesting.

Indirect. There would be continued degradation in the quality and quantity of the trees within the study area and vicinity, greatly reducing the potential for forestry activities, such as timber harvesting. It is anticipated that timber resources within the study area would not reach merchantable size over the 50-year period of analysis. Existing tree stands would not be regenerated because of continued substrate degradation.

Cumulative. Cumulative impacts would be additive to the impacts from wetland loss and degradation throughout coastal Louisiana. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and

degradation impacts to forestry throughout the region and state (see Figure 5.1 and Table 5.2).

5.15.12.2.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to forestry, including timber harvesting.

Indirect. Channel Improvement, Flowage and Deposition, and Wetland Creation and Restoration easements would be placed within the primary and secondary areas of impact for Alternative 33 (Recommended Plan), effectively restricting timber harvesting within portions of the study area over an indefinite period of time. Therefore this alternative would have negative impacts on timber harvesting within portions of the study area. The Real Estate Plan in Appendix J provides descriptions of the easements which will be placed within the areas of impact.

Cumulative. This alternative would have negative additive effects on timber harvesting. Timber harvesting would be very limited, if not completely reduced, in the benefit areas. Cumulative impacts would be additive to other impacts to forestry throughout the region and state

5.15.12.2.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.12.3 Public Lands

5.15.12.3.1 No-Action Alternative

Direct. There would be no direct impacts to public lands, such as Maurepas Swamp Wildlife Management Area (WMA).

Indirect. Adverse indirect impacts could occur to nearby public lands as a result of swamp degradation and conversion to fresh marsh and open water. Impacts could also result from the consequent loss of storm damage benefits currently provided by the existing nearby swamp habitat. A portion of the Maurepas WMA is the only public lands present in the study area.

Cumulative. Cumulative impacts would be additive to the wetland loss and degradation throughout coastal Louisiana. A portion of the Maurepas Wildlife Management Area (WMA) is the only public lands present within the study area. These lands may be adversely affected by future sea level rise and continued

habitat conversion and land loss. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to public lands throughout the region and state (see Figure 5.1 and Table 5.2).

5.15.12.3.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to public lands, such as Maurepas Swamp Wildlife Management Area since Alternative 33 (Recommended Plan) project components are not located or being implemented near or within the WMA.

Indirect. There would be minor beneficial indirect impacts by restoring the swamp adjacent to the public lands because the forested habitat within the project footprint will provide storm surge and windfall protection to nearby public lands.

Cumulative. Cumulative impacts would be additive to the wetland loss and degradation throughout coastal Louisiana. A portion of the Maurepas WMA is the only public lands present within the study area. These lands may be adversely affected by future sea level rise and continued habitat conversion and land loss. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to public lands throughout the region and state (see Figure 5.1 and Table 5.2).

5.15.12.3.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.13 Navigation

5.15.13.1 No-Action Alternative

Direct. There would be no direct impacts to navigation, commercially since there is little commercial fisheries within the study area, or recreationally.

Indirect. The degradation and loss of wetlands contribute to increased maintenance costs of navigation infrastructure.

Cumulative. Cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area. As Louisiana's coastal wetlands continue to fragment and convert to open water, the protection wetlands provide to inland waterways from wind-driven waves would likely be

reduced. Amite River and Bayou Manchac Federal navigation channel and AR&T flood control channel are likely to continue to be used primarily for recreational navigation. Inland vessels, such as barge traffic, would be subjected to more open water marine-like conditions.

5.15.13.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to navigation, commercially or recreationally.

Indirect. Beneficial indirect impacts could occur as a result of wetland restoration, such as the sustainability of portions of the ARDC and other navigation channels in the area.

Cumulative. This alternative would have positive effects on navigation when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). Cumulative impacts would be the protection of navigation channels.

5.15.13.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.14 Man-Made Resources

5.15.14.1 Oil, Gas, Utilities and Pipelines

5.15.14.1.1 No-Action Alternative

Direct. There would be no direct impacts to oil and gas utilities or pipelines as a result of the No-Action alternative.

Indirect. Wetland land loss increases the vulnerability of pipelines and other infrastructure.

Cumulative. Increasing O&M costs as well as increasing investment in oil and gas production facilities and pipelines, increasing vulnerability of pipelines and other infrastructure due to widespread coastal wetland loss. Wells are likely to remain and active pipelines likely to be present.

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time. The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand

berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources projects and studies within the Louisiana coastal area. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available. If at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

Ongoing documentation of the impacts associated with the Deepwater Horizon Oil spill can be found in several governmental sources. The USFWS Situation Report for August 22, 2010 (http://www.fws.gov/home/dhoilspill/pdfs/MondayAugust22010.pdf) indicates the following environmental-related Deepwater Horizon oil spill information: 563 personnel are actively engaged in the response, working to protect wildlife and their habitats, including 36 national wildlife refuges. They are also assessing the damage from the oil spill in preparation for the work that will be needed to restore the Gulf of Mexico.

- Overall number of personnel responding: approximately 30,100
- Total vessels responding: more than 4,500
- Total boom deployed: more than 2,155 miles
- Boom available: more than 856 miles
- Oily water recovered: more than 34.7 million gallons
- Estimated 11.14 million gallons of oil burned
- Estimated total of more than 1.84 million gallons of dispersant used including:
    - Estimated more than 1.07 million gallons surface dispersant used
    - Estimated more than 771,000 gallons of sub-sea dispersant used:
- Estimated approximately 632 miles of Gulf Coast shoreline is currently oiled—approximately 365 miles in Louisiana, 111 miles in Mississippi, 68 miles in Alabama, and 88 miles in Florida.

5.15.14.1.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct beneficial or adverse impacts to oil and gas utilities or pipelines.

Indirect. There would be no indirect beneficial or adverse impacts to oil and gas utilities or pipelines.

Cumulative. This alternative would have positive effects on the protection of oil, gas, utilities, and pipelines when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2). These facilities would be less susceptible to storm surges and other damage due to wetland loss.

5.15.14.1.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.14.2 Flood Control and Hurricane Protection

5.15.14.2.1 No-Action Alternative

Direct. There would be no direct impacts to flood control, such as the ARDC or the Chinaquapin Canal, or hurricane protection levee projects since there are none located within the study area.

Indirect. There would be a continued degradation of forested habitat within the study area, which provides valuable storm-surge and windfall protection from tropical storms. Therefore, there could be an increase in storm surge and risk of flooding due to coastal land loss. As populations continue to migrate to coastal communities, increasing investments in hurricane and flood control levees, pump stations, and other flood control facilities would be required.

Cumulative. Cumulative impacts would be increased flood damages from hurricane events, and land loss and degradation throughout coastal Louisiana. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to flood control and hurricane protection throughout the region and state. However, the negative impacts of wetland loss to flood control and hurricane protection within the study area and vicinity would be offset to some extent by other Federal, state, local, and private restoration efforts across coastal Louisiana, including the West Lake Shore Pontchartrain Hurricane Protection Project (see Figure 5.1 and Table 5.2).

5.15.14.2.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to flood control and hurricane protection levee projects. Implementation of Alternative 33 (Recommended Plan) would have an insignificant reduction in the stage on the Amite River and on the ARDC. As a result, there would not be an increased risk of

flooding for nearby businesses and residences. An insignificant increase in stage height within the swamp area, near the proposed openings in the ARDC dredged material berms, would occur. There are no hurricane protection levee projects within the study area; therefore, there will be no direct impacts to hurricane protection projects.

Indirect. There would be a restoration of forested habitat within the study area, which provides valuable storm surge and windfall protection from tropical cyclone events. Consequently, there could be an increase in storm surge protection and decrease in flooding risk with coastal land retention. As populations continue to migrate to coastal communities, increasing investments in hurricane and flood control levees, pump stations, and other flood control facilities would be required.

Cumulative. This alternative would have a positive additive effect on hurricane protection. The proposed action would nourish existing swamp habitat and create swamp habitat that is currently converting and has converted to open water. The reduction of conversion of swamp to open water would provide for some protection from storm surges and wave action. Cumulative impacts include the increased sustainability of portions of the ARDC, a flood control channel. The impacts to flood control and hurricane protection levee projects within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana, including the West Lake Shore Pontchartrain Hurricane Protection Project (see Figure 5.1 and Table 5.2).

5.15.14.2.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).
Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).
Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.15.15 Natural Resources

5.15.15.1 Commercial Fisheries

5.15.15.1.1 No-Action Alternative

Direct. There would be no direct impacts on commercial fisheries, including catfish harvesting within the Blind River or Petite Amite River. There are no oyster leases within the study area; therefore, no direct impacts would occur.

Indirect. Indirect impacts would result in the persistence of existing conditions including the continued conversion of existing wetlands to open water habitat, continued bankline erosion, and sloughing of the existing shoreline.

Cumulative. Cumulative impacts would be the continued effects on commercial fisheries from wetland loss and degradation throughout coastal Louisiana. Globally, overfishing and habitat change has resulted in the depletion of 90 percent of the world's seafood resources, with 38 percent of the species studied experiencing greater than 90 percent depletion, and 7 percent becoming extinct (Worm *et al.*, 2006). This trend is expected to continue under the No-Action Alternative. Throughout Louisiana and the study area, the loss of commercial fishery habitat due to the loss of essential wetland habitat and salinity changes is likely to occur. Other cumulative impacts include the conversion of 18,204 acres of swamp to a shallow open water system within the study area, which would be additive with other swamp losses and degradation impacts to commercial fisheries throughout the region and state. The positive impacts of restoration to commercial fisheries within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.15.1.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impact on commercial fisheries, including catfish harvesting within the Blind River or Petite Amite River. There are no oysters within the study area; therefore, no direct impacts would occur.

Indirect. Wetland restoration would indirectly create and restore fisheries habitat. This would support populations of fishery species and enhance commercial fishing opportunities, including catfish harvesting and crabbing, within the study area and vicinity.

Cumulative. Habitat loss for commercial fisheries would continue due to the land loss and wetland deterioration in coastal Louisiana. A net total of 1,602 acres of swamp habitat would be restored and nourished. The positive impacts of restoration to commercial fisheries within the study area and vicinity would be additive to some extent with other Federal, state, local, and private restoration efforts across coastal Louisiana (see Figure 5.1 and Table 5.2).

5.15.15.1.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan).

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan).

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.16 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The Phase I Environmental Site Assessment (ESA) for the study area identified two Recognized Environmental Concerns (RECs) that may have adversely impacted, or may potentially impact, environmental conditions in the study area: Underground Storage Tanks (USTs) at the former Chinquapin Grocery, and Aboveground Storage Tanks (ASTs) at Val's Marina. Although there are no records in the LDEQ's database regarding leaks from the two RECs, no soil and/or groundwater samples were collected to confirm that leaks did or did not occur. There is no visible evidence of spills or leaks in the vicinity of the RECs. Although located within the study area boundaries, neither of the two identified RECs are in close proximity to the portions of the study area projected to be impacted by the implementation of any of the final array of alternatives under consideration. Therefore, neither of the RECs located within the study area would likely expose the public or construction workers to HTRW or to adversely affect the project. If the project area changes, however, then additional investigation may be necessary. The HTRW report is provided in Appendix M.

5.16.1 No-Action Alternative

Direct. There would be no direct impacts to HTRW.

Indirect. There would be no indirect impacts to HTRW.

Cumulative. Within the study area, increasing human populations and industrialization are likely to result in increased potential for HTRW problems.

5.16.2 Alternative 33 (Recommended Plan)

Direct. There would be no direct impacts to HTRW since neither REC is in close proximity to the portions of the study area projected to be impacted by the implementation of Alternative 33 (Recommended Plan).

Indirect. There would be no indirect impacts to HTRW since neither REC is in close proximity to the portions of the study area projected to be impacted by the implementation of Alternative 33 (Recommended Plan).

Cumulative. There would be no cumulative impacts on HTRW. HTRW issues are unlikely to occur when combined with other Federal, state, local, and private restoration efforts (see Figure 5.1 and Table 5.2).

5.16.3 Alternatives 34-39

Direct. Direct impacts would be similar to Alternative 33 (Recommended Plan) since neither REC is in close proximity to the portions of the study area projected to be impacted by the implementation of any of the final array of alternatives under consideration.

Indirect. Indirect impacts would be similar to Alternative 33 (Recommended Plan) since neither REC is in close proximity to the portions of the study area projected to be impacted by the implementation of any of the final array of alternatives under consideration.

Cumulative. Cumulative impacts would be similar to Alternative 33 (Recommended Plan).

5.17 UNAVOIDABLE ADVERSE IMPACTS

The unavoidable adverse impacts resulting from implementation of any one of the seven proposed actions within the final array of alternatives would be the temporary impacts associated with construction, such as the loss of some trees within the project footprint, noise impacts due to the operation of large equipment, and the initial loss of some habitat during the clearing phase of the construction process. All of these impacts are considered temporary and have no impact on the long-term environmental impacts resulting from the proposed actions.

5.18 RELATIONSHIP OF SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

All seven proposed actions within the final array of alternatives, including the Recommended Plan would increase the long-term productivity of healthy freshwater swamp regeneration within the study area. Added hydrologic connectivity and reductions in impoundment would play a critical role in supplying the swamp habitat with nutrient and sediments on a seasonal basis. The addition of vegetative plantings would also serve as a means of initiating the regeneration and germination of cypress/tupelo swamp habitat within the most highly-degraded areas.

5.19 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Of all seven proposed actions within the final array of alternatives, excluding the No-Action Alternative, the irreversible and irretrievable commitments of resources would include the opening of the dredged material berms and the loss of existing vegetative resources during construction. All of these commitments would result in increased benefits for the study area and therefore, would not be viewed as a long-term negative impact.

5.20 MITIGATION

All seven alternatives, including the Recommended Plan, would generate a net gain in benefits; therefore, no mitigation would be required for implementation and

construction of this proposed action. The Recommended Plan would result in a net gain of 679 AAHUs.

5.21 ENVIRONMENTAL CONSEQUENCES SUMMARY

The continued swamp degradation and conversion to marsh and open water leads to increased competition between wetland-dependent wildlife populations, displacement to other more suitable swamp wetland areas, and localized decline in wildlife populations. The loss of forest canopy would select against many species, such as neotropical migrants and nesting birds. The conversion to open water would select against small and large mammals, but may offer some more habitat for dabbling ducks.

The overall effect of all proposed actions within the final array of alternatives, excluding the No-Action Alternative, would be a net increase in benefits for the environmental resources within the study area with little to no negative impacts. The Recommended Plan would create a net gain of 679 AAHUs for the areas of impact. The No-Action Alternative would result in the continued degradation of the cypress/tupelo swamp habitat along with the wildlife and aquatic resources within the study area. The long-term effects of no Federal action would be the eventual conversion of thousands of acres of freshwater swamp to open water within the next 50 years.

6.0 PUBLIC INVOLVEMENT

6.1 NEPA SCOPING

A Notice of Intent (NOI) to prepare a Draft Supplemental EIS (DSEIS) for the LCA ARDC Modification Feasibility Study was published on December 22, 2008 in the Federal Register (Volume 73, Number 246). It was subsequently determined that an SEIS would be included in an Integrated Feasibility Report as a supplement to the 2004 LCA ARDC report.

The public scoping meeting was held on February 12, 2009, in French Settlement, Louisiana. A total of 30 multi-part comments were received during the comment period. A total of 86 specific comments were expressed. The comments received were incorporated into the planning formulation process in the identification of goals, objectives, study area problems and the management measures considered.

Comments were evaluated for recurring themes to gain an understanding of the key issues to address in the SEIS. Primary concerns uncovered in the comments were:

- Weir at French Settlement does not function properly and diverts excessive flow to ARDC, impairing lower Amite River.
- Project should incorporate weir construction at downstream end of ARDC.
- ARDC construction has disrupted natural hydrologic regime and damaged properties.
- Endangered/protected species are present in the study area and vicinity.
- Scope of project should address wildlife and fisheries habitat.
- Hydrology and Hydraulics modeling should be expansive, incorporate conditions from other projects, and/or involve stage data collection.

The scoping comments were documented in a Scoping Report and describe the public's concerns about the restoration effort and strategies for restoration efforts. All registered scoping meeting participants, as well as those providing written or verbal comments, were provided a copy of the Scoping Report. In addition, the Scoping Report was posted on the study website at http://www.lca.gov. Scoping comments received to date are summarized in Tables 6.1 and 6.2. All public comments received on the draft FS/SEIS are summarized in Appendix G.

Table 6.1. Public Scoping Comment Themes by Percentages of Occurrence

Ranking	Theme	Number of Comments	Percent Occurrence
1	Weir at French Settlement does not function properly and diverts excessive flow to ARDC, impairing lower Amite River.	10	12.2%
2	Project should incorporate weir construction at downstream end of ARDC.	7	8.5%
3	ARDC construction has disrupted natural hydrologic regime and damaged properties.	6	7.3%
4	Endangered/protected species are present in the study area and vicinity.	6	7.3%
5	Scope of project should address wildlife and fisheries habitat.	6	7.3%
6	H&H modeling should be expansive, incorporate conditions from other projects, and/or involve stage data collection.	6	7.3%
7	Project should incorporate rehabilitation of weir at French Settlement.	5	6.1%
8	Southwestern boundary of study area should be expanded.	5	6.1%
9	Boat trips to reconnaissance study area are needed.	4	4.9%
10	Diversion canal stages are primarily influenced by Lake Maurepas.	4	4.9%
11	Gap placement is an issue because of development on dredged material berms.	4	4.9%
12	Swamps south of Bayou Pierre are impaired from acidity caused by lack of hydrologic exchange.	3	3.7%
13	Project is greatly needed and should be completed on an expedited schedule.	3	3.7%
14	Project should include vegetative planting or nature control.	3	3.7%
15	Create hydrologic exchange between Bayou Pierre and ARDC on south canal bank.	2	2.4%
16	Colonial nesting waterbird rookeries are present in the study area.	2	2.4%
17	Draining swamp waters may impair water quality in ARDC and downstream.	2	2.4%
18	Project should operate under flood events, not merely normal flow or high flow conditions.	1	1.2%
19	Dredged material berm gapping has been implemented as part of waterfront development projects in study area.	1	1.2%
20	Avoidance or minimization of forest habitat impacts should be considered during gap location.	1	1.2%
21	Project scope should include restoration of lower Amite River	1	1.2%
Total:		**82**	**100%**

Note: The number of occurrences totals 82 because a given comment can be associated with more than one theme. The percentages are based on dividing the number of occurrences of a given theme by the total number of occurrences and multiplying by 100.

Table 6.2. Public Scoping Comments Considered

Rank	Theme	Comment Incorporation or Consideration
1	Weir at French Settlement does not function properly and diverts excessive flow to ARDC, impairing lower Amite River.	Weir rehabilitation was considered as a measure in Section 3 of this study (WR-01). While we recognize that rehabilitation to the weir might be necessary, it was determined that the performance of the weir would have little to no effect to restoring the degraded portions of the study area. During the preliminary phases of the plan formulation process, rehabilitation of the weir was considered and subsequently screened out due to a lack of restoration opportunities this measure would provide.
2	Project should incorporate weir construction at downstream end of ARDC.	Weirs were considered as potential measures, but were screened out. This process is described in detail in Section 3 of the report (WC-01 through WC-08).
3	ARDC construction has disrupted natural hydrologic regime and damaged properties.	The objective of this project is to restore hydrologic connectivity to the area.
4	Endangered/protected species are present in the study area and vicinity.	Environmental consequences are discussed in detail in Section 5 of this report.
5	Scope of project should address wildlife and fisheries habitat.	Environmental consequences are discussed in detail in Section 5 of this report.
6	H&H modeling should be expansive, incorporate conditions from other projects, and/or involve stage data collection.	The LCA Blind River/Hope Canal Diversion projects were considered in the Hydrology and Hydraulics analysis, and the study area chosen was considered adequate for the purposes of the analysis needed. The H&H analysis is included in Appendix L, Section 2.
7	Project should incorporate rehabilitation of weir at French Settlement.	Rehabilitation does not efficiently contribute to the accomplishment of the goals for this project. This was considered as a measure in section 3 of this study (WR-01)
8	Southwestern boundary of study area should be expanded.	The study area subunit SW-2 was expanded to cover additional area to the south and west of the outline proposed during the public scoping meeting.
9	Boat trips to reconnaissance study area are needed.	Several reconnaissance boat trips were made.
10	Diversion canal stages are primarily influenced by Lake Maurepas.	Modeling shows that this is true.
11	Gap placement is an issue because of development on dredged material berms.	This was considered as a part of the project, and it was determined that the maximum benefit could be achieved without locating the gaps in developed areas.
12	Swamps south of Bayou Pierre are impaired from acidity caused by lack of	Measures describing consideration given to Bayou Pierre are described in Section 3 (BO-

Rank	Theme	Comment Incorporation or Consideration
	hydrologic exchange.	01, BO-02, CD-02, CS-02, CS-03, CS-04, SR-02)
13	Project is greatly needed and should be completed on an expedited schedule.	We concur.
14	Project should include vegetative planting or nature control.	These measures are included as a part of the Recommended Plan and are described in Section 3 (VP-01, VP-02).
15	Create hydrologic exchange between Bayou Pierre and ARDC on south canal bank.	Measures describing consideration given to Bayou Pierre are described in Section 3 (BO-01, BO-02, CD-02, CS-02, CS-03, CS-04, SR-02)
16	Colonial nesting waterbird rookeries are present in the study area.	Environmental consequences are discussed in detail in Section 5 of this report.
17	Draining swamp waters may impair water quality in ARDC and downstream.	No long-term water quality impacts are expected downstream of this project. Water quality impacts are discussed in detail in Section 5.3 of this report.
18	Project should operate under flood events, not merely normal flow or high flow conditions.	Design will operate in said conditions.
19	Dredged material berm gapping has been implemented as part of waterfront development projects in study area.	Analysis was conducted including existing gaps as a part of this study, and the recommended plan of action was to create larger gaps to increase hydrologic connectivity.
20	Avoidance or minimization of forest habitat impacts should be considered during gap location.	The alternatives were chosen based on the maximum net benefit possible, therefore minimization of impacts was considered.
21	Project scope should include restoration of lower Amite River	Lower Amite River is outside the scope of the project and will not be included.

6.2 OTHER PUBLIC COMMENTS, AREAS OF CONTROVERSY, UNRESOLVED ISSUES

The following meetings were held to provide opportunities for the public, landowners, NGOs, agencies, the Parishes and other interested parties to see progress on the project and to solicit feedback from the attendees.

- Livingston Parish - August 6, 2008
- Ascension Parish - July 30, 2008
- Public Scoping Meeting - February 12, 2009
- Louisiana Department of Wildlife and Fisheries - June 15, 2009
- LCA Science Board Presentation - July 16, 2009
- Livingston Parish- August 6, 2009
- Ascension Parish- August 6, 2009

- Landowner - August 31, 2009
- Conservation Fund - November 2, 2009
- Conservation Fund - February 4, 2010
- Conservation Fund - February 9, 2010
- Livingston Parish- February 23, 2010
- Public Feasibility Scoping Meeting - June 24, 2010

6.2.1 Land Owner Involvement

Mr. Glen Martin, part owner of Blind River Properties Inc. and majority land owner within the ADRC study area, has been granted a permit to develop the southern bank of the ARDC in a manner similar to the development constructed on the northern shore. Several meetings have been held with Mr. Martin in which proposed project alternatives were presented. Mr. Martin supports restoration in the study area.

6.2.2 Non-Governmental Organization (NGO) Involvement

Both the Lake Pontchartrain Basin Foundation and the Coalition to Restore Coastal Louisiana provided support and suggestions about the ARDC modification project through a joint letter dated February 20th, 2009 to the commander of the New Orleans office of the USACE. On November 2, 2009, February 4, 2010 and February 9, 2010, meetings were held with the Louisiana Conservation Fund (LCF) along with the Audubon Society to collaborate future LCA ARDC efforts with LCF goals.

6.2.3 Parish Involvement

The study area for the LCA ARDC modification project is located within Ascension and Livingston Parishes. Separate meetings were held between representatives of Ascension and Livingston Parish, in order to solicit feedback on the project objectives and to report on the progress to date. Continual coordination between the LCA ARDC Project Delivery Team (PDT) and Parish representatives has occurred, Additional meetings have been held with Livingston Parish to prepare for the potential coordination between the Hydrologic Restoration in Swamps West of Lake Maurepas CIAP and the LCA ARDC projects.

6.3 PUBLIC COMMENTS ON THE DSEIS

The Integrated Feasibility Report and Supplemental Environmental Impact Study (SEIS) was released to the public on May 21, 2010, and was followed by a 45-day public review period ending on July 6, 2010. Additionally, a public meeting was held on June 24, 2010 in French Settlement Louisiana. Comments received and the responses to them are included in Appendix G.

7.0 COORDINATION AND COMPLIANCE

7.1 U. S. ARMY CORPS OF ENGINEERS (USACE) PRINCIPLES AND GUIDELINES (P&G)

This section documents the coordination and compliance efforts regarding statutory authorities including: environmental laws, regulations, executive orders, policies, rules, and guidance. Consistency of the TSP/Recommended Plan with other Louisiana coastal restoration efforts is also described.

7.2 ENVIRONMENTAL COORDINATION AND COMPLIANCE

Following completion of the Supplemental Environmental Impact Study (SEIS), the Assistant Secretary of the Army for Civil Works will issue a written Record of Decision (ROD) concerning the proposed action. The ROD will be issued within a framework of laws, regulations, executive orders, policies, rules, and other guidance. These authorities establish regulatory compliance standards for environmental resources pertaining directly to USACE management of water resources development projects, or provide planning guidance for the management of environmental resources. Relevant Federal statutory authorities and executive orders are listed in Table 7.1 of the SEIS. Relevant State of Louisiana statutory authorities are listed in Table 7.2 of the SEIS. Full compliance with statutory authorities will be accomplished upon review of the Final Feasibility Report and SEIS by appropriate agencies and the signing of a ROD, in compliance with the Fish and Wildlife Coordination Act (1958).

If a proposed project feature within the Recommended Plan is changed significantly or is not implemented within one year of the USFWS Final Coordination Act Report, the USACE will reinitiate coordination with the USFWS to insure that the proposed action would not adversely affect any Federally-listed threatened or endangered species or their critical habitat. Additionally, all further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documentation) will be coordinated with the USFWS and other state and Federal natural resource agencies, and those agencies would be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

Table 7.1. Relevant Federal Statutory Authorities and Executive Orders (Note: This list is not complete or exhaustive)

Abandoned Shipwreck Act of 1987	Marine Mammal Protection Act of 1972
American Indian Religious Freedom Act of 1978	Marine Protected Areas (EO 13158) of 2000
Anadromous Fish Conservation Act of 1965	Marine Protection, Research, and Sanctuaries Act of 1972
Archaeological Resources Protection Act of 1979	
Archaeological and Historical Preservation Act of	Migratory Bird Conservation Act of 1929

1974	Migratory Bird Treaty Act of 1918
Bald Eagle Protection Act of 1940	Migratory Bird Habitat Protection (EO 13186) of 2001
Clean Air Act of 1970	National Environmental Policy Act of 1969
Clean Water Act of 1977	National Historic Preservation Act of 1966
Coastal Barrier Improvement Act of 1990	National Invasive Species Act of 1996
Coastal Barrier Resources Act of 1982	Native American Graves Protection and Repatriation Act of 1990
Coastal Wetlands Planning, Protection, and Restoration Act of 1990	Neotropical Migratory Bird Conservation Act of 2000
Coastal Zone Management Act of 1972	Noise Control Act of 1972
Coastal Zone Protection Act of 1996	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1996
Comprehensive Environmental Response, Compensation, and Liability Act of 1980	North American Wetlands Conservation Act of 1989
Consultation and Coordination with Indian Tribal Governments (EO 13175) of 2000	Oil Pollution Act of 1990
Deepwater Port Act of 1974	Outer Continental Shelf Lands Act of 1953
Emergency Planning and Community Right-to-Know Act of 1986	Pollution Prevention Act of 1990
Emergency Wetlands Restoration Act of 1986	Prime or Unique Farmlands, 1980 CEQ Memorandum
Endangered Species Act of 1973	Protection and Enhancement of the Cultural Environment (EO 11593) of 1971
Environmental Quality Improvement Act of 1970	Protection and Enhancement of Environmental Quality (EO 11991) of 1977
Estuaries and Clean Waters Act of 2000	Protection of Children from Environmental Health Risks and Safety Issues (EO 13045) of 1997
Estuary Protection Act of 1968	Protection of Cultural Property (EO 12555) of 1986
Estuary Restoration Act of 2000	Protection of Wetlands (EO 11990) of 1977
Exotic Organisms (EO 11987) of 1977	Reclamation Projects Authorization and Adjustments Act of 1992
Farmland Protection Policy Act of 1981	Recreational Fisheries (EO 12962) of 1995
Federal Actions to Address Environmental Justice in Minority Populations & Low-Income Populations (EO 12898, 12948) of 1994, as amended	Resource Conservation and Recovery Act of 1976
Federal Compliance with Pollution Control Standards (EO 12088) of 1978	Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186) of 2001
Federal Emergency Management (EO 12148) of 1979	Rivers and Harbors Acts of 1899, 1956
Federal Water Pollution Control Act of 1972	River and Harbor and Flood Control Act of 1970
Federal Water Project Recreation Act of 1965	Safe Drinking Water Act of 1974
Fish and Wildlife Conservation Act of 1980	Submerged Land Act of 1953
Fish and Wildlife Coordination Act of 1958	Sustainable Fisheries Act of 1996
Flood Control Act of 1944	Title VI, Section 601 of the Civil Rights Act of 1964
Floodplain Management (EO 11988) of 1977	Toxic Substances Control Act of 1976
Food Security Act of 1985	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646)
Greening of the Government Through Leadership in Environmental Management (EO 13148) of 2000	Water Resources Development Acts of 1976, 1986, 1990, 1992, and 2007
Historic Sites Act of 1935	Water Resources Planning Act of 1965
Historical and Archaeological Data-Preservation Act of 1974	Watershed Protection & Flood Prevention Act of 1954
Indian Sacred Sites (EO 13007) of 1996	Water Pollution Control Act Amendments of 1961
Invasive Species (EO 13112) of 1999	Wild and Scenic River Act of 1968
Land & Water Conservation Fund Act of 1965	Wilderness Act of 1964
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended	

Table 7.2. Relevant State Statutory Authorities
(Note: This list is not complete or exhaustive)

Air Control Act	Louisiana Threatened and Endangered Species and Rare & Unique Habitats
Archeological Treasury Act of 1974	Protection of Cypress Trees
Louisiana Coastal Resources Program	Water Control Act
Louisiana Natural and Scenic Rivers	

7.2.1 Clean Water Act – Section 404(b)(1)

The USACE is responsible for administering regulations under Section 404(b)(1) of the Clean Water Act. Potential project-related impacts subject to these regulations, such as the discharge of dredged material into shallow open water areas to create wetlands have been evaluated in compliance with Section 404(b)(1) of the Clean Water Act (Appendix D). All relevant Federal and state authorities and Executive Orders are found in Tables 7.1 and 7.2. The evaluation of potential impacts to water quality indicated that, on the basis of the guidelines, the proposed disposal sites for the discharge of dredged material comply with the requirement of these guidelines, with the inclusion of appropriate and practicable methods to minimize adverse effects to the aquatic ecosystem. Water Quality Certification was received on September 20, 2010 and is included in Appendix D.

7.2.2 Section 122 of the Rivers and Harbors Act

Section 122 of the Rivers and Harbors Act of 1970 (Public Law 91-611, 84 STAT. 1823) requires that consideration be given to possible adverse economic, social and environmental effects. It also requires that final decisions on the project be made in the best overall public interest, taking into consideration the need for flood control, navigation and associated purposes; and the associated costs of eliminating or minimizing the following adverse affects:

Air, water and noise pollution;
Destruction or disruption of man-made and natural resources, aesthetic values, community cohesion, and availability of public facilities and services;
Adverse employment effects;
Tax and property value losses;
Injurious displacement of people, businesses and farms; and
Disruption of desirable community and regional growth.

7.2.3 Coastal Zone Management Act of 1972

Section 307 of the Coastal Zone Management Act (CZM) of 1972 (16 U.S.C. 1456(c)(1)(A)) directs Federal agencies proposing activities or development projects (including civil work activities), whether within or outside the coastal zone, to assure that those activities or projects are consistent, to the maximum extent

practicable, with the approved state coastal zone management program. A Coastal Zone Consistency Determination will be included with this report has been submitted to Louisiana Department of Natural Resources (LDNR) for consistency review. A Consistency Determination received on August 9, 2010 and is included in Appendix E. Implementation of the Recommended Plan is considered consistent, to the maximum extent practicable, with the approved Louisiana state coastal management program.

7.2.4 Endangered Species Act of 1973

Compliance with the Endangered Species Act (ESA) (7 U.S.C. 136; 16 U.S.C. 460 *et seq*.) has been coordinated with the USFWS and the NMFS for those species under their respective jurisdictions. The use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid project construction impacts to any threatened or endangered species or their critical habitat within the proposed action area. The USACE would continue to closely coordinate and consult with the USFWS and the NMFS regarding threatened and endangered species under their jurisdiction that may be potentially impacted by the proposed action. Although Gulf sturgeon and West Indian manatee may be Recommended Plan to these species are unlikely (see also Section 5.11 Threatened and Endangered Species). A Biological Assessment is included in this report (Appendix A). Comments and concurrence from the USFWS on the proposed action are included in Appendix G.

7.2.5 Magnuson-Stevens Fishery Conservation and Management Act of 1996; and the Magnuson-Stevens Act Reauthorization of 2006 Essential Fish Habitat (EFH)

As directed by the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 104-297), the USACE has coordinated with NMFS and that agency's experts on various marine organisms as well as EFH. NMFS indicated that the study area may contain some habitat for euryhaline species such as Gulf menhaden and striped mullet, but that EFH is not present within the study area (see also Section 5.10 EFH).

7.2.6 Clean Air Act – Air Quality Determination

Compliance with the Clean Air Act (42 U.S.C.A. § 7401) has been fully coordinated with the Air Quality Section of the Louisiana Department of Environmental Quality (LDEQ) (see also Section 4.2.4 Air Quality). As required by Louisiana Administrative Code, Title 33 (LAC 33:III.1405 B), an air quality applicability determination was made for the Recommended Plan. This included consideration of the proposed action for the category of general conformity, in accordance with the Louisiana General Conformity, State Implementation Plan (LDEQ, 1994). An air

quality determination has been calculated, based upon direct and indirect air emissions (Section 5.4). Generally, since no other indirect Federal action, such as licensing or subsequent actions would likely be required or related to the restoration construction actions, it is likely that indirect emissions, if they would occur, would be negligible. Therefore, the air applicability determination analysis was based upon direct emission for estimated construction hours. Considering that total emissions for each work item separately (or even when all work items are summed) would not exceed the threshold limit applicable to VOCs for parishes where the most stringent requirement (50 tons per year in serious non-attainment parishes) is in effect, (see General Conformity, State Implementation Plan, Section 1405 B.2), the Volatile Organic Compounds (VOC) emissions for the proposed construction would be classified as de minimus and no further action would be required.

7.2.7 National Historic Preservation Act of 1966

In compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36CFR 800, Federal agencies are required to identify and consider potential effects that their undertakings might have on any significant historic property, district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. Additionally, a Federal agency shall consult with any tribe that attaches religious and cultural significance to such properties. Agencies shall afford the State Historic Preservation Office (SHPO) and tribes a reasonable opportunity to comment before decisions are made. Accordingly, the proposed action has been coordinated with the SHPO and tribes. The coordination letter received from the SHPO, as well as the Programmatic Agreement, are included in Appendix F. The LCA ARDC Integrated Feasibility Report and SEIS was provided to the SHPO and tribes, as well as other interested parties for comment (see also Section 5.12).

7.2.8 Farmland Protection Policy Act (Prime and Unique Farmlands)

The purpose of the Farmland Protection Policy Act (7 U.S.C. 658) is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. There are no prime and unique farmlands within the study area. Hence, there would be no unnecessary or irreversible conversion of prime and unique farmland to non-agricultural uses.

7.2.9 Executive Order 13186 – Migratory Bird Habitat Protection

Executive Order 13186 proclaims the intent to support the conservation of previous migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency

actions (Section 5.7). This Executive Order requires environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern. In addition, each Federal agency shall restore and enhance the habitat of migratory birds, as practicable. Implementation of the Recommended Plan would result in a net increase in migratory bird habitat.

7.2.10 Executive Order 12898 – Environmental Justice

Concern with environmental justice issues can be traced to Title VI, Section 601 of the Civil Rights Act of 1964 (Public Law 88-352):

> *No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.*

On February 11, 1994, President Clinton issued Executive Order 12898 regarding Federal actions to address environmental justice issues in minority populations and low-income populations:

> *To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.*

Executive Order 12898 is designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities. The order is also intended to promote non-discrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low income communities access to public information on, and an opportunity for public participation in, matters relating to human health or environmental planning, regulations, and enforcement. Potential Environmental Justice issues have been considered throughout the entire study process, and would continue to be considered through project implementation. As part of the NEPA process, a scoping input request was provided to the public and interested parties. Comments did not identify any potential environmental justice issues. The USACE is committed to ensuring that any potential environmental justice issues are addressed as the study proceeds. The proposed ecosystem

restoration measures would equally impact all potential users in the area. There would be no potential environmental justice issues from implementing the Recommended Plan (Section 5.15.4).

7.2.11 Executive Order 13112 – Invasive Species

On February 3, 1999, President Clinton issued Executive Order 13112 to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause by establishing the National Invasive Species Council. Alternative 33 (Recommended Plan) is consistent with Executive Order 13112 to the extent practicable and permitted by law and subject to the availability of appropriations, and within Administration budgetary limits. Alternative 33 (Recommended Plan) would use relevant programs and authorities to prevent the introduction of invasive species and not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere, unless the USACE has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize risk of harm would be taken in conjunction with the actions (Section 5.6.5).

7.2.12 Executive Order 11990 – Protection of Wetlands

President Jimmy Carter issued Executive Order 11990: Protection of Wetlands on May 24, 1977 (42 FR 26961, 3 CFR, 1977 Comp., p. 121) in order to avoid, to the extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands. Executive Order 11990 directs that each Federal agency shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Consistent with Executive Order 11990, the following factors have been considered as part of the alternative plan formulation process in developing the Recommended Plan for ecosystem restoration and avoiding potential effects on the survival and quality of wetlands (Appendix D):

a) Public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion;
b) Maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources; and
c) Other uses of wetlands in the public interest, including recreational, scientific, and cultural uses.

7.2.13 Executive Order 11988 – Floodplain Management

Executive Order 11988 - Floodplain Management directs all Federal agencies to avoid, if possible, development and other activities in the 100-year base floodplain. Where the base floodplain cannot be avoided, special considerations and studies for new facilities and structures are needed.

Design and siting are to be based on scientific, engineering, and architectural studies; consideration of human life, natural processes, and cultural resources; and the planned period of analysis of the project. Federal agencies are required to:

- Reduce the risk of flood loss;
- Minimize the impact of floods on human safety, health, and welfare; and
- Restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.

The proposed action area is located in Zone A (no base flood elevation determined) of the Special Flood Hazard Areas inundated by 100-year flood (Source: National Flood Insurance Program, Firm Flood Insurance Rate Map, Livingston Parish, Louisiana, Unincorporated Areas, Panel 250 of 275, Community-Panel Number 220113 0250 B, effective date September 30, 1988, Federal Emergency Management Agency). Consistent with Executive Order 11988, implementing the Recommended Plan would have no significant impacts on the risk of flood loss. Furthermore, implementing the Recommended Plan would have no significant flooding impacts on human safety, health and welfare. Implementing the Recommended Plan, ecosystem restoration of portions of the Maurepas Swamp, would contribute to restoring and preserving the natural and beneficial values served by floodplains (Section 5.15.14.2).

7.2.14 Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646)

All real estate interests acquired for construction of the Recommended Plan would be in accordance with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act), as amended in 42 USC 4601-4655, and the Uniform Regulations contained in 49 C.F.R. Part 24. The Uniform Act sets forth procedures for the acquisition of private property for public use and specifically requires that the acquiring agency appraise the real property interests it wishes to acquire and provide the owner a written summary of the basis for the amount established as just compensation (Appendix J).

7.2.15 Louisiana State Rare, Threatened, and Endangered Species, and Natural Communities Coordination

The USACE reviewed the database maintained by the Louisiana Natural Heritage Program (LNHP) that provides the most recent listing and locations for rare, threatened and endangered species of plants and animals and natural communities within the State of Louisiana. The proposed action is not likely to adversely affect any rare, threatened or endangered species, or unique natural communities. The proposed action would increase the extent of bald cypress-tupelo swamp within portions of the study area, which are identified as rare natural communities for certain regions of the state (see also Section 5.6 Vegetation Resources and 5.11 Threatened and Endangered Species).

7.2.16 Clean Water Act – Section 401 Water Quality

Under provisions of the Clean Water Act (33 U.S.C. § 1251), any project that involved placing dredged or fill material in waters of the United States or wetlands, or mechanized clearing of wetlands would require a water quality certification from the LDEQ, Office of Environmental Services. A SEIS addressing impacts of all activities associated with the proposed LCA ARDC Modification project has been prepared. The document includes an assessment of impacts of excavation, dredging, and disposal operations. Application for certification has been submitted by the U.S. Army Engineer District, New Orleans, to the LDEQ, Office of Environmental Services, in accordance with statutory authority contained in LRS: 30:2074 A(3) and provisions of Section 401 of the Clean Water Act (P.L. 92-500, as amended) (Appendix D). A Water Quality Certification was received on September 20, 2010 and is included in Appendix D.

7.2.17 U.S. Fish and Wildlife Coordination Act Report

The USACE and the USFWS have formally committed to work together to conserve, protect, and restore fish and wildlife resources while ensuring environmental sustainability of our Nation's water resources under the January 22, 2003, Partnership Agreement for Water Resources and Fish and Wildlife. Accordingly, the USFWS indicated agreement to serve as a Cooperating Agency (per NEPA section 1501.6) in developing the SEIS for the proposed project in accordance with applicable NEPA and CEQ guidance. Participation of the USFWS includes (1) participating in meetings and field trips to obtain baseline information on project area fish and wildlife resources; (2) evaluating the proposed project's impacts to wetlands and associated fish and wildlife resources, and assisting in the development of measures to avoid, minimize, and/or compensate for those impacts; and (3) providing technical assistance in the development of a Biological Assessment describing the impacts of the proposed activity to Federally listed threatened or endangered species and/or their critical habitat. In the January 20,

2009, letter, the USFWS also provided specific guidance on avoiding impacts to West Indian manatee (*Trichechus manatus*), Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), bald eagle (*Haliaeetus leucocephalus*), and colonial nesting waterbirds. The U.S. Fish and Wildlife Coordination Letter and Report are provided in Appendix B. We received concurrence on the Biological Assessment and recommendations in a draft Coordination Act Report (CAR) in a letter from the USFWS, dated June 29, 2010. The final CAR was received on September 2, 2010.

Additionally, USACE has coordinated with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries as per the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401), as amended by the Act of June 24, 1936. A Final coordination act letter report (Appendix B) has been received the services position and recommendations are as follows:

The TSP will benefit the fish and wildlife resources of the LCA-ARDC area by providing freshwater, nutrients, and sediments to the study area thus facilitating sediment deposition, increase organic production, increase biological productivity, and reduce conversion of swamp habitat to open water. Approximately 679 AAHUs and 1,602 net acres of swamp habitats would benefit by the proposed project at the end of the project life. The Service supports implementation of Alternative 33 provided the following fish and wildlife recommendations are implemented concurrently with project implementation:

1. *If authorized funding limits for this project are increased the Service recommends that Alterative 39 be reconsidered as the potential future TSP.*

2. *Prioritize those measures that are contained in the NER plan that are not included within the TSP based on cost-effectiveness. In addition, advertise the most cost-effective measures in the NER plan that are missing from the TSP as additive alternates if funds for this project are authorized by Congress and the project is advertised for construction bids.*

3. *If a proposed project feature is changed significantly or is not implemented within one year of the Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with our office to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their critical habitat.*

4. *Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. A qualified biologist should inspect the proposed work site for the presence of undocumented wading bird nesting colonies and bald eagles*

during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies, and October through mid-May for bald eagles).

5. *To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.*

6. *Because bald eagles are known to nest within the proposed study area, we recommend that an evaluation be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary and those results should be forwarded to this office.*

7. *Land clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.*

8. *Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on the all work addressed in those reports.*

9. *A report documenting the status of implementation, maintenance and adaptive management measures should be prepared every three years by the managing agency and provided to the Corps, the Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Office of Coastal Protection and Restoration, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities, and identify any proposed changes to the existing management plan.*

References to the above USFWS recommendations and how each was addressed are as follows:

- Recommendation 1 is addressed in Sections 1.5.1, 3.7, 3.9.6 and 6.2.3 of this report;
- Recommendation 2 is addressed in Section 3.7 of this report;

- Recommendations 3 and 8 are addressed in Section 7.2 of this report;
- Recommendations 4 and 7 are addressed in Section 5.7.2 of this report;
- Recommendations 5 and 6 are addressed in Section 4.2.7 of this report; and
- Recommendation 9 is addressed in Section 3.7.5 and Appendix I of this report.

8.0 CONCLUSIONS AND DETERMINATIONS

8.1 AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

The State of Louisiana, the U.S. Army Corps of Engineers (USACE), landowners within the study area, and public stakeholders, have agreed on the goals, purpose, and findings of this study, and there are no known areas of controversy or unresolved issues.

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time. The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources projects and studies within the Louisiana coastal area. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available. If at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

8.2 CONCLUSIONS

The Recommended Plan, Alternative 33 includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps would be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 mile north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.
- Installation of nutria guards on all newly planted trees to protect against tree loss.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity on the north bank. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project.

The implementation of the recommended plan would result in long-term, sustainable ecosystem restoration. Fish, wildlife, and freshwater swamp habitat would be restored and maintained. The project outputs are cost-effective and consistent with the mission of the USACE and the State of Louisiana Coastal Protection and Restoration Authority (CPRA). This plan is acceptable to the public and the State of Louisiana and the Project Delivery Team (PDT). The Non-Federal Sponsor shall, prior to implementation, agree to perform the items of local cooperation as discussed in Section 3.9.

8.3 RECOMMENDATIONS

I recommend that Alternative 33 be constructed under the authority of Section 7006(e)(3)(b) of the Water Resources Development Act (WRDA) 2007. Alternative 33 includes the creation of three conveyance channels through the dredged material berm of the ARDC to improve connectivity that would greatly increase the movement of freshwater, sediments, and nutrients to and from the bald cypress-tupelo swamp. It also includes planting of 438 and 5 acres of the study area with freshwater swamp and bottomland hardwood tree species, respectively. The recommended plan is an implementable increment of the NER plan, has been determined to be cost effective, is within the cost and scope of the authorization, has stand-alone utility, is supported by the non-Federal sponsor, and can be justified based on ecosystem restoration benefits. Alternative 33 would create 679 Average Annual Habitat Units (AAHUs), would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement. The project total first cost, based on October 2010 price levels, is estimated at $8,136,000. The total fully funded project cost is estimated at $8,540,000 Micro-Computer Aided Cost Estimating System (MCACES) and the average annualized cost per AAHUs is $660. This restoration would greatly benefit fish and wildlife resources, freshwater swamp habitat, and improve water quality. This project would be cost shared by the non-Federal sponsor, the State of Louisiana at 35 percent non-Federal and 65 percent Federal. The Non-Federal Sponsor shall,

prior to implementation, agree to perform the items of local cooperation as stated in Section 3.9.2.

The recommendations contained herein reflects the information available at this time, price levels as specified in the FS/SEIS, and current departmental policies governing the formulation of the project. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher levels of review within the Executive Branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for implementation funding.

Edward Fleming

Colonel, U.S. Army
District Engineer

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9.0 DISTRIBUTION LIST AND OTHER

9.1 DISTRIBUTION LIST

The LCA ARDC Integrated Feasibility Report and Supplemental Environmental Impact Statement (FS/SEIS) will be distributed to Federal, state, parish, and local agencies; tribes; businesses; libraries; museums; universities; environmental organizations, groups and individuals; and scoping participants. The complete distribution list would be available upon request from the U.S. Army Corps of Engineers at the following address.

U.S. Army Corps of Engineers
New Orleans District
P.O. Box 60267
New Orleans, Louisiana 70160-0267

9.2 LIST OF PREPARERS

Many individuals were involved with the completion of this document. Table 9.1 lists those people who assisted in the writing of the LCA ARDC FS/SEIS. Table 9.1 is alphabetized by preparers' last name.

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9.4 GLOSSARY

Acceptability	Adequate to satisfy a need, requirement, or standard. One of the USACE requirements for a project.
Adaptive Management	An interdisciplinary approach acknowledging our insufficient information base for decision-making; that uncertainty and change in managed resources are inevitable; and that new uncertainties will emerge. An iterative approach that includes monitoring and involves scientists, engineers and others who provide information and recommendations that are incorporated into management actions; results are then followed with further research, recommendations and management actions, and so on.
Air Quality Determination	The Louisiana Department of Environmental Quality ensures that projects do not adversely affect air quality through this determination as a requirement of the Clean Air Act.
Alternative Plan	A set of one of more management measures functioning together to address one or more objectives.
Amplitude	The maximum absolute value of a periodically varying quantity.
Anadromous	Species that ascend rivers from the sea to spawn.

Anoxia	Absence of oxygen.
Anthropogenic	Caused by human activity.
Average Annual Habitat Unit (AAHU)	Represent a numerical combination of habitat quality and quantity (acres) existing at any given point in time. The habitat units resulting from the future without- and future with-project scenarios are annualized, averaged over the project life, to determine Average Annual Habitat Units (AAHUs).
Benefits	Valuation of positive performance measures.
Benthic	Living on or in sea, lake, or stream bottoms.
Biomass	The total mass of living matter (plant and animal) within a given unit of environmental area.
Bottomland Hardwood Forest	Low-lying forested wetlands found along streams and rivers found at higher elevations than swamp.
Clean Water Act Section 404 (b) (1)	There are several sections of this Act which pertain to regulating impacts to wetlands. The discharge of dredged or fill material into waters of the United States is subject to permitting specified under Title IV (Permits and Licenses) of this Act and specifically under Section 404 (Discharges of Dredge or Fill Material) of the Act.
Coastal Zone Consistency Determination	The U.S. Environmental Protection Agency reviews plans for activities in the coastal zone to ensure they are consistent with Federally approved State Coastal Management Programs under Section 307(c)(3)(B) of the Coastal Zone Management Act.
Coastwide Plan	Combination of alternative plans assembled to address an objective or set of objectives across the entire Louisiana Coast.
Comprehensive Plan	Same as coast-wide Plan.
Conditional Authorization	Authorization for implementation of a project subject to approval of the project feasibility-level decision document by the Assistant Secretary of the Army for Civil Works.

Congressional Authorization	Authorization for investigation to prepare necessary feasibility-level report to be recommended for authorization of potential future project construction by Congress.
Connectivity	Property of ecosystems that allows for exchange of resources and organisms throughout the broader ecosystem.
Continental Shelf	The edge of the continent under gulf waters; the shallow Gulf of Mexico fringing the coast.
Control Structure	A gate, lock, or weir that controls the flow of water.
Cumulative Impacts	The combined effect of all direct and indirect impacts to a resource over time.
Datum	A point, line, or surface used as a reference, as in surveying, mapping, or geology.
Decomposition	Breakdown or decay of organic materials.
Degradation Phase	The phase of the deltaic cycle when sediments are no longer delivered to a delta, and it experiences erosion, dieback, or breakup of marshes.
Deltaic Cycle	The repeating pattern of delta development, progression, and abandonment. As sediments are deposited at the mouth of the distributary channels, the delta progresses seaward. The main channel then switches to a new course with a shorter reach to the depositional basin. Abandoned delta lobes decrease in elevation due to continued subsidence and sediment compaction, resulting in retreat of the shoreline. Abandoned lobes may be partially or wholly covered by new lobes during later deltaic cycles.
Deltaic Deposits	Mud and sand deposited at the mouth of a river.
Deltaic Plain	The land formed and reworked as the Mississippi River switched channels in the eastern part of the Louisiana coastal area.
Detritus	The remains of plant material that has been destroyed or broken up.

Dewatering	The process of dredged sediments compacting while losing water after being deposited.
Discharge	The volume of fluid passing a point per unit of time, commonly expressed in cubic feet per second, millions of gallons per day, or gallons per minute.
Dissolved Oxygen	Oxygen dissolved in water, available for respiration by aquatic organisms. One of the most important indicators of the condition of a water body.
Direct Impacts	Those effects that result from the initial construction of a measure (e.g., marsh destroyed during the dredging of a canal). Contrast with "Indirect Impacts."
Diurnal	Active during the day.
Diversion	A turning aside or alteration of the natural course or flow of water. In coastal restoration this usually consists of such actions as channeling water through a canal, pipe, or conduit to introduce water and water-borne resources into a receiving area.
Dredged material embankments (Dredged material berms, Side-cast Banks, Excavated Material Banks)	Dredged material removed from canals and piled in a linear mound along the edge of canals.
Dynamic	Characterized by continuous change and activity.
Ecological	Refers to the relationship between living things and their environment.
Economic	Of or relating to the production, development, and management of material wealth, as of a country, household, or business enterprise.
Ecosystem	An organic community of plants and animals viewed within its physical environment (habitat); the ecosystem results from the interaction between soil, climate, vegetation, and animal life.

Ecosystem Restoration	Activities that seek to return an organic community of plants and animals and their habitat to a previously existing or improved natural condition or function.
Effectiveness	Having an intended or expected effect. One of the USACE requirements for a project.
Efficiency	The quality of exhibiting a high ratio of output to input. One of the USACE requirements for a project.
Egress	A path or opening for going out; an exit.
Embankment	A linear mound of earth or stone existing or built to hold back water or to support a roadway.
Encroachment	Entering gradually into an area not previously occupied, such as a plant species distribution changing in response to environmental factors such as salinity.
Endangered Species	Animals and plants that are threatened with extinction.
Engineering News Record (ENR)	A magazine that provides news needed by anyone in or from the construction industry.
Enhance	To augment or increase/heighten the existing state of an area.
Environmental Impact Statement (EIS)	A document that describes the positive and negative environmental effects of a proposed action and the possible alternatives to that action. The EIS is used by the Federal government and addresses social issues as well as environmental ones.
Estuary	A semi-enclosed body of water with freshwater input and a connection to the sea where fresh water and salt water mix.
Estuarine	Related to an estuary.
Evaporation	The process by which any substance is converted from a liquid state into, and carried off in, vapor; as, the evaporation of water.

Exotic Species	Animal and plant species not native to the area; usually undesirable (e.g., hyacinth, nutria, tallow tree, giant salvinia).
Feasibility Report	A description of a proposed action, previously outlined in a general fashion in a Reconnaissance Report, that will satisfy the Federal interest and address the problems and needs identified for an area. It must include an assessment of impacts to the environment (either in an Environmental Assessment, or the more robust Environmental Impact Statement), an analysis of alternative methods of completion, and the selection of a Recommended Plan through the use of a cost-effectiveness analysis.
Feature	A constructible increment of an alternative plan.
Federal Principals Group	A collaboration among Federal agencies at the Washington level to facilitate the flow of information, to provide guidance and recommendations to the USACE and OCPR throughout the study process, and to facilitate resolution of any interagency issues that may be identified in the conduct of the study.
Final Array	The final grouping of the most effective plans from which a final recommendation can be made.
Fresh Marsh	Intertidal herbaceous plant community typically found in that area of the estuary with salinity ranging from 0-3 ppt.
Furbearer	An animal whose skin is covered with fur (mammal), especially fur that is commercially valuable, such as muskrat, nutria, and mink.
Geomorphic	Related to the geological surface configuration.
Goals	Statements on what to accomplish and/or what is needed to address a problem without specific detail.
Gradient	A slope; a series of progressively increasing or decreasing differences in a system or organism.
Habitat	The place where an organism lives; part of physical environment in which a plant or animal lives.

Habitat Loss	The disappearance of places where target groups of organisms live. In coastal restoration, usually refers to the conversion of marsh or swamp to open water.
Habitat Units (HUs)	Represent a numerical combination of quality (HSI) and quantity (acres) existing at any given point in time. The HUs resulting from the future without- and future with-project scenarios are annualized, averaged over the project life, to determine Average Annual Habitat Units (AAHUs). The "benefit" of a project can be quantified by comparing AAHUs between the future without- and future with-project scenarios. The difference in AAHUs between the two scenarios represents the net benefit attributable to the project in terms of habitat quantity and quality.
Hazardous, Toxic, and Radioactive Wastes (HTRW)	Wastes that contain toxic constituents, or that may cause hazardous chemical reactions, including explosive or flammable materials, or radioactive wastes, which, improperly managed may present a hazard to human health or the environment.
Headland	A point of land projecting into the sea or other expanse of water, still connected with the mainland.
Herbaceous	A plant with no persistent woody stem above ground.
Hydrodynamic	The continuous change or movement of water.
Hydrology	The pattern of water movement on the earth's surface, in the soil and underlying rocks, and in the atmosphere.
Hypoxia	The condition of low dissolved oxygen concentrations.
Indirect Impacts	Those effects that are not as a direct result of project construction, but occur as secondary impacts due to changes in the environment brought about by the construction. Contrast with "Direct Impacts."
Infrastructure	The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons.

Ingress	An entrance or the act of entering.
Inorganic	Not derived from living organisms; mineral; matter other than plant or animal.
Intermediate Marsh	Intertidal herbaceous plant community typically found in that area of the estuary with salinity ranging from 2-5 ppt.
Intertidal	Alternately flooded and exposed by tides.
Invertebrates	Animals without backbones, including shrimp, crabs, oysters, and worms.
Leeward	Sheltered from the wind; away from the wind.
Levee	A linear mound of earth or stone built to prevent a river from overflowing; a long, broad, low ridge built by a stream on its flood plain along one or both banks of its channel in time of flood. Levees are used in the New Orleans Hurricane Storm Damage Risk Reduction System.
Maintain	To keep in existing state.
Methodology	A set of practices, procedures, and rules.
Mineral Substrate	Soil composed predominately of mineral rather than organic materials; less than 20 percent organic material.
National Ecosystem Restoration (NER)	USACE standard for cost-effectiveness based on ecosystem, not economic, benefits.
National Environmental Policy Act (NEPA)	Ensures that Federal agencies consider the environmental impacts of their actions and decisions. NEPA requires all Federal agencies to consider the values of environmental preservation for all significant actions and prescribes procedural measures to ensure that those values are fully respected.
Net Gain	The amount of cumulative land gain less land loss, when gain is greater than loss.
Net Loss	The amount of cumulative land gain less land loss, when gain is less than loss.

No Action Alternative	The alternative in the NEPA document which describes the ecosystem of the coastal area if no restoration efforts/projects were done.
Nursery	A place for larval or juvenile animals to live, eat, and grow.
Objectives	More specific statements than "Goals," describing how to achieve the desired targets.
Organic	Composed of or derived from living things.
Oxidation of Organic Matter	The decomposition (rotting, breaking down) of plant material through exposure to oxygen.
Oxygen-depleted	Situation of low oxygen concentrations where living organisms are stressed.
Potable Water	Water that is fit to drink.
ppt	Parts per thousand. The salinity of ocean water is approximately 35 ppt.
Prime Farmland	Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. One of the categories of concern in the NEPA document.
Principles	Framing statements that can be used to evaluate alternatives while considering issues that affect them. Used along with targets and assessments of ecosystem needs to provide guidance in formulation of alternative plans.
Productivity	Growth of plants and animals.
Progradation	The phase during the deltaic cycle where land is being actively accreted through deposition of river sediments near the mouth.
Programmatic Environmental Impact Statement (PEIS)	And Environmental Impact Statement that supports a broad authorization for action, contingent on more specific detailing of impacts from specific measures.

Province	A major division of the coastal area of Louisiana. (e.g., Deltaic Plain and Chenier Plain).
Quantitative	Able to assign a specific number; susceptible to measurement.
Reduce	To diminish the rate or speed of a process.
Rehabilitate	To focus on historical or pre-existing ecosystems as models or references while emphasizing the reparation of ecosystem processes, productivity and service.
Relative Sea Level Rise	The sum of the sinking of the land (subsidence) and eustatic sea level rise; the change in average water level with respect to the surface.
Restore	Return a wetland to an approximation of its condition or function prior to disturbance by modifying conditions responsible for the loss or change; re-establish the function and structure of that ecosystem.
Salinity	The concentration of dissolved salts in a body of water, commonly expressed as parts per thousand.
Scoping	Soliciting and receiving public input to determine issues, resources, impacts, and alternatives to be addressed in the draft EIS.
Sea level	Long-term average position of the sea surface.
Sheet Flow	Flow of water, sediment, and nutrients across a flooded wetland surface, as opposed to through channels.
Supplemental Environmental Impact Statement (SEIS)	Typically prepared after either a Final EIS or Record of Decision has been issued and new environmental impacts that were not considered in the original EIS are discovered, requiring the lead agency to re-evaluate its initial decision and consider new alternatives to avoid or mitigate the new impacts. Supplemental EISs are also prepared when the size and scope of a Federal action changes, or when all of the proposed alternatives in an EIS are deemed to have unacceptable environmental impacts and new alternatives are proposed.
Social	Relating to human society and its modes of organization.

Socioeconomic	Involving both social and economic factors.
Stabilize	To fix the level or fluctuation of; to make stable.
State Historic Preservation Office (SHPO)	The part of the Louisiana Department of Culture, Recreation, and Tourism that oversees consultation and compliance with Section 106 of the National Historic Preservation Act for Federally funded, permitted, or approved projects.
Storm Surge	An abnormal and sudden rise of the sea along a shore as a result of the winds of a storm.
Strategy	Ecosystem restoration concept from the Coast 2050 Plan.
Stream Gauging Data	Records of water levels in streams and rivers.
Submergence	Going under water.
Subprovince	The divisions of the two Provinces (see "Province") into smaller groupings: 1) east of the Mississippi River; 2) west of the Mississippi River to Bayou Lafourche; 3) Bayou Lafourche to Freshwater Bayou; 4) Freshwater Bayou to Sabine River.
Subsidence	The gradual downward settling or sinking of the Earth's surface with little or no horizontal motion.
Sustain	To support and provide with nourishment to keep in existence; maintain.
Target	A desired ecosystem state that meets an objective or set of objectives.
Terrestrial Habitat	The land area or environment where an organism lives; as distinct from water or air habitats.
Toxicity	The measure of how poisonous something is.
Transpiration	The process by which water passes through living plants into the atmosphere.
Turbidity	The level of suspended sediments in water; opposite of clarity or clearness.

Upland	A general term for non-wetland elevated land above low areas along streams or between hills.
Water Resources Development Act (WRDA)	A bill passed by Congress that provides authorization and/or appropriation for projects related to the conservation and development of water and related resources.
Weir	A low head dam placed across a canal or river to raise, divert, regulate or measure the flow of water.

9.5 ACRONYMS, ABBREVIATIONS, SYMBOLS, AND INITIALISMS

AAHU	Average Annual Habitat Unit
ACHP	Advisory Council on Historic Preservation
AFB	Alternative Formulation Briefing
AQI	Air Quality Index
ARDC	Amite River Diversion Canal
AR&T	Amite River and Tributaries
ASA (CW)	Assistant Secretary of the Army (for Civil Works)
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
ATR	Agency Technical Review
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
BRP	Blind River Properties
CAR	U.S. Fish and Wildlife Service, Coordination Act Report
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEM	Conceptual Ecological Model
CEMVN	Corps of Engineers Mississippi Valley New Orleans
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CIAP	Coastal Impact Assistance Program
CO	Carbon Monoxide
COE	Corps of Engineers
CPRA	Coastal Protection and Restoration Authority
CRMS	Coastwide Reference Monitoring System
CS	Clearing and Snagging
CSA	Cost Share Agreement
CWA	Clean Water Act

CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
CZM	Coastal Zone Management Act of 1972
DBH	Diameter at Breast Height
DEMCO	Dixie Electric Membership Corporation
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DOA	Department of the Army
DOTD	Department of Transportation and Development
DSEIS	Draft Supplement Environmental Impact Statement
DWC	Division Water Company
EATEL	East Ascension Telephone Company
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Orders
EOP	Environmental Operating Principles
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Endangered Species Act
ESA	Phase I Environmental Site Assessment
FCSA	Feasibility Cost Share Agreement
FMC	Fishery Management Council
FMP	Fishery Management Plan
FSWC	French Settlement Water Company
ft	Feet
FWOP	Future Without Project
FWP	Future With Project
GIS	Geographic Information System
HEC-RAS	Hydraulic Engineering Centers River Analysis
H&H	Hydraulics and Hydrology
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic and Radioactive Waste
ICA	Incremental Cost Analysis
ISQG	Interim Sediment Quality Guidelines
ITR	Independent Technical Review
IWR	Institute for Water Resources
LA	Louisiana
LACPR	Louisiana Coastal Protection and Restoration
LCA	Louisiana Conservation Area
LCF	Louisiana Conservation Fund
LCWCR	Louisiana Coastal Wetlands Conservation and Restoration Authority
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force

LDAF	Louisiana Department of Agriculture and Forestry
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LERRD	Lands, Easements, Right-of-Way, Relocation, and Disposal Areas
LNHP	Louisiana National Heritage Program
m	Meters
MBTA	Migratory Bird Treaty Act
MCACES	Micro-Computer Aided Cost Engineering System
mm	Millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MR&T	Mississippi River and Tributaries
MRC	Mississippi River Commission
MSA	Metropolitan Statistical Area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
msl	Mean Sea Level
MVD	U.S. Army Corps of Engineers, Mississippi Valley Division
MVN	U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum
NBEM	National Bald Eagle Management Guidelines
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NERP	National Ecosystem Restoration Act
NGO	Non-governmental Organization
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NRC	National Resource Council
NRCS	National Resources Conservation Service
NWI	National Wetlands Inventory
OCPR	Office of Coastal Protection and Restoration
OCS	Outer Continental Shelf
OMRR&R	Operations, Maintenance, Repair, Replacement, and Rehabilitation
ONWR	Outstanding Natural Resource Water
OSHA	Occupational Safety and Health Administration

Pb	Lead
P&G	Principles and Guidelines
PCR	Primary Contact Recreation
PDT	Project Delivery Team
PED	Planning, Engineering, and Design
PGM	Planning Guidance Memo
Pm	Particulate Matter
PMP	Project Management Plan
PPA	Project Partnership Agreement
PPL	Priority Project List
POR	Period of Record
PRP	Preliminary Restoration Plan
ppt	Parts per Thousand
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RCRAGN	Resource Conservation and Recovery Act Generator
RCRATSD	Resource Conservation and Recovery Act Treatment, Storage, and Disposal
REC	Recognized Environmental Condition
REP	Real Estate Plan
ROD	Record of Decision
ROE	Rights-of-Entry
RSLR	Relative Sea level Rise
RV	Recreational Vehicle
S&A	Supervision and Administration
SAV	Submerged Aquatic Vegetation
SCR	Secondary Contact Recreation
SEIS	Supplemental Environmental Impact Statement
SET	Surface Elevation Table
SHPO	State Historic Preservation Office
SONRIS	Strategic Online Natural Resources Information System
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasure Plan
S&T	Science and Technology
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
THPO	Tribal Historic Preservation Officer
TM	Landsat Thematic Mapper
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TOD	Tract Ownership Data
TRI	Toxic Release Inventory
TSP	Tentatively Selected Plan
TSS	Total Suspended Solids

um	Micrometers
USDA	United States Department of Agriculture
USACE	U.S. Army Corps of Engineers
USACE-MVM	U.S. Army Corps of Engineers-Mississippi Valley Memphis District
USACE-MVN	U.S. Army Corps of Engineers-Mississippi Valley New Orleans District
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VE	Value Engineering
VOC	Volatile Organic Compound
VRAP	Visual Resources Assessment Procedure
WBS	Work Breakdown Structure
WC	Weir Construction
WCRF	Wetland Conservation and Restoration Fund
WR	Weir Rehabilitation
WCRA	Wetland Conservation and Restoration Authority
WRDA	Water Resources Development Act
WMA	Wildlife Management Area
WVA	Wetland Value Assessment
yr	Year

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MAIN REPORT

ATTACHMENT 1

Non-Federal Sponsor's Letter of Intent

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CPRA
Coastal Protection and
Restoration Authority of Louisiana

Colonel Edward R. Fleming
New Orleans District
U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

August 9. 2010

Dear Col. Fleming:

The State of Louisiana is pleased to offer its continuing support of the Louisiana Coastal Area (LCA) Multi-purpose Operation of the Houma Canal Lock, Terrebonne Basin Barrier Shoreline Restoration, Small Diversion at Convent/Blind River, Amite River Diversion Canal Modification, Medium Diversion at White's Ditch, and Convey Atchafalaya River Water to Northern Terrebonne Marshes projects as authorized in the Water Resources Development Act of 2007 (WRDA 2007). These projects are a critical part of the overall LCA Program and a vital component in rehabilitating the natural system of coastal Louisiana that serves to protect the economic and energy security of both the state and nation, the safety of more than 2 million Louisiana residents, the ecological balance of the Gulf region, and the survival of a unique culture.

This letter, while not legally binding on the State as an obligation of future funds appropriated by the State Legislature, declares our full support for the LCA Multi-purpose Operation of the Houma Canal Lock, Terrebonne Basin Barrier Shoreline Restoration, Small Diversion at Convent/Blind River, Amite River Diversion Canal Modification, Medium Diversion at White's Ditch, and Convey Atchafalaya River Water to Northern Terrebonne Marshes projects as described in the draft reports dated August 2010, with cost sharing as required in WRDA 2007. Accordingly, the State acknowledges that the projects require the non-Federal sponsor to contribute 35% of the total project costs, including all lands, easements, rights-of-way, relocations, and any improvements on lands, easements, and rights-of-way required for disposal of dredged material. The State also acknowledges that it will be required to perform all activities necessary to operate, maintain, rehabilitate, repair and replace the projects at the State's expense, including the performance of renourishment for the Terrebonne Basin Barrier Shoreline Restoration Project features as described in the feasibility report for that project. The State of Louisiana fully supports these projects, and the Coastal Protection and Restoration Authority will make diligent efforts to secure all necessary funding, including asking the State legislature for additional appropriations if necessary. Nevertheless, the Coastal Protection and Restoration Authority and the State of Louisiana reserve the right to seek the enactment of Federal law to reduce the non-Federal cost share.

The State of Louisiana and the Coastal Protection and Restoration Authority whole-heartedly endorse this and other Corps' efforts to restore Louisiana's coastal ecosystem, and we look forward to working with the Corps on the implantation of these important projects.

Respectfully,

Garret Graves
Chair
Coastal Protection and Restoration Authority

Volume II of VI–LCA Amite River Diversion Canal Modification

Integrated Feasibility Study and Environmental Impact Statement

For the

LCA Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

(APPENDICES A – M)

The responsible lead Federal agency for this study is the U. S. Army Engineer District, *New Orleans*. The Non-Federal Sponsor for the study is *the Louisiana Coastal Protection and Restoration Authority*. The responsible cooperating Federal agency is the *U.S. Fish and Wildlife Service*. This report is a combined feasibility report and environmental impact statement complying with requirements of the U.S. Army Corps of Engineers (USACE) and the Council of Environmental Quality (CEQ), and is intended to reduce duplication and paperwork. An asterisk (*) in the table of contents notes paragraphs that are required for National Environmental Policy Act (NEPA) compliance.

October 2010

U.S Army Corps of Engineers
New Orleans District

Coastal Protection and Restoration Authority

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Appendix A

BIOLOGICAL ASSESSMENT

APPENDIX A

BIOLOGICAL ASSESSMENT

AMITE RIVER DIVERSION CANAL MODIFICATION PROJECT, LIVINGSTON AND ASCENSION PARISHES, LOUISIANA

1.0 PURPOSE

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that, *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried, out by such agency…. Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…".*

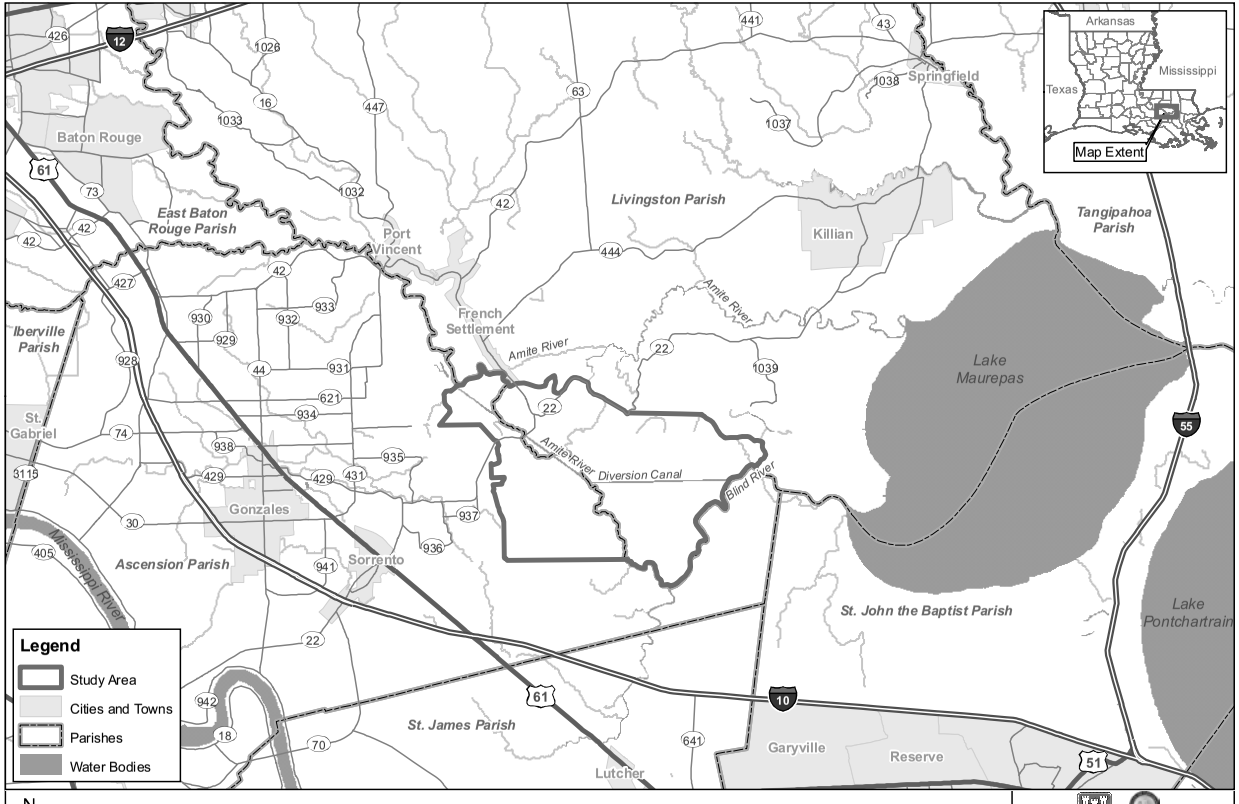
This Biological Assessment provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, *et seq.;* the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 *et seq*.); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940.

This Biological Assessment (BA) evaluates the potential impacts of the Tentatively Selected Plan (TSP) described in the Integrated Feasibility Report and Environmental Impact Statement for the Amite River Diversion Canal (ARDC) Modification project on Federally-listed threatened and endangered species, and their critical habitat. This evaluation is presented to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to achieve compliance with the requirements of Section 7 of the ESA for consultation with USFWS and NMFS.

2.0 LOCATION AND GENERAL DESCRIPTION OF THE STUDY AREA

The Louisiana Coastal Area (LCA) program study area (LCA ARDC) (Figures 1 and 2) is situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal; and is located in the following sections:

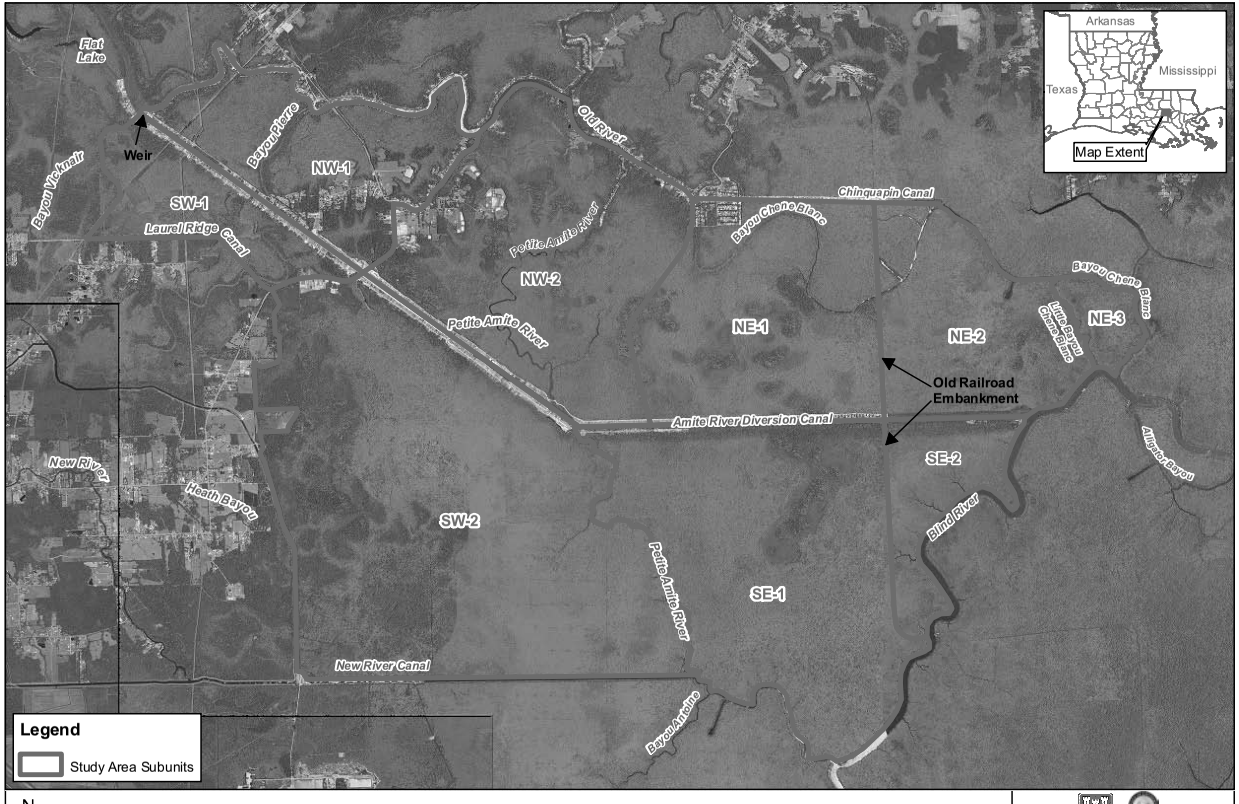
- Township 9 South, Range 4 East, Sections 9-16, 22-27, and 34-36;
- Township 9 South, Range 5 East, Sections 7, 14-36;
- Township 9 South, Range 6 East, Section 30;



STUDY AREA REGION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 1
Date: October 2009
Scale: 1:260,000
Source: USDA/GEC
Map ID: 27850108-1781



STUDY AREA AND SUBUNITS

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 2
Date: October 2009
Scale: 1:80,000
Source: USDA/GEC
Map ID: 27850108-1780

- Township 10 South, Range 4 East, Sections 1-3 and 10-12; and
- Township 10 South, Range 5 East, Sections 2-11.

For planning purposes, the study area has been divided into nine separate hydrologic subunits (Figure 2). Each subunit was developed based on hydrologic differences that exist throughout the study area due to natural and manmade hydrologic boundaries. These boundaries include natural topography such as dredged material berms and natural ridges, as well as man-made and natural canals.

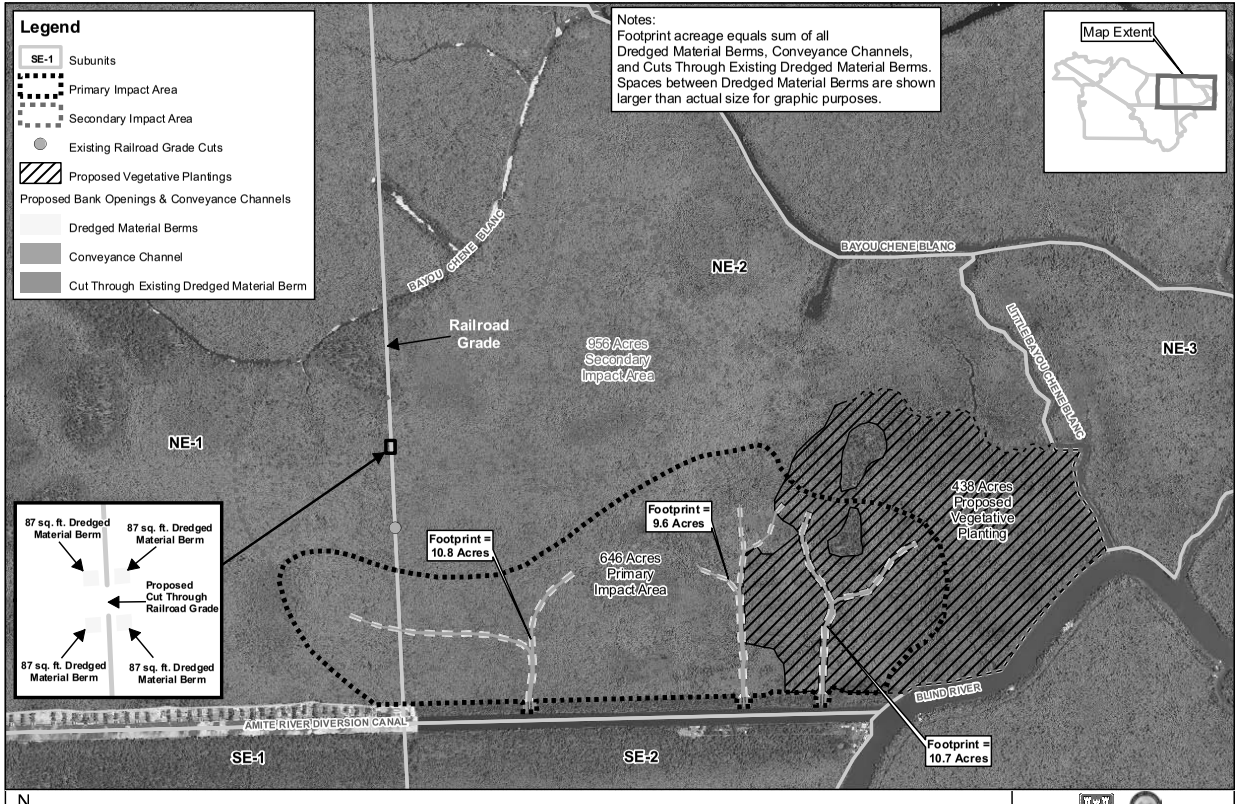
3.0 PROPOSED ACTION

Alternative 33 of the LCA ARDC Integrated Feasibility Report and Supplemental Environmental Impact Statement (SEIS) is the Tentatively Selected Plan (TSP), which is depicted in Figure 3. Features of the TSP include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, would be based on four design cross-sections. These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile. These channels have existed for quite some time without any maintenance. The cross-sections include a 70-foot wide cut section with benches through dredged material berm, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches was designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.



ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868

4.0 SPECIES DESCRIPTIONS

Two endangered species have been identified as potentially occurring within the boundaries of the study area. Therefore, the proposed action could possibly impact the Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) and the West Indian manatee (*Trichechus manatus*).

The American alligator *(Alligator mississippiensis)*, a common inhabitant of the study area, is classified by USFWS as "Similarity of Appearance to a Threatened Taxon." (The species to which it is similar is the American crocodile (*Crocodylus acutus)*, a threatened species.)

In addition, the study area contains a nesting pair of bald eagles (*Haliaeetus leucocephalus).* The bald eagle was removed from the endangered species list in 2007, but is currently undergoing five years of monitoring to confirm the revised status.

The two endangered species, Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), and West Indian manatee (*Trichechus manatus*), could potentially be found in the project area. Nevertheless, the features of the proposed action would not adversely impact either species' critical habitat, which is not present within the study area. Manatees are rare transient foragers in the study area.

4.1 AMERICAN ALLIGATOR *(ALLIGATOR MISSISSIPPIENSIS)*

The American alligator's range extends across the southeastern states from North Carolina to Texas (University of Florida, 1998). This reptile's primary habitat includes freshwater swamps and marshes, but it also inhabits rivers, lakes and smaller bodies of water. Alligators are an important part of their ecosystem, and many biologists consider them a "keystone" species, performing many functions, from control of prey species to the creation of peat through their nesting activities (University of Florida, 1998). Populations of the American alligator severely declined in the early part of the 20th century, due to hunting of the animal for its skin. In 1967, this species was listed as endangered, and hunting was prohibited. As a result, the alligator has undergone a successful recovery. Alligator hunting is allowed again; however, permits are issued by lottery only during alligator hunting season.

The alligator is classified by USFWS as "Similarity of Appearance (Threatened)." The species to which it is similar is the American crocodile (*Crocodylus acutus)*, a threatened species. In the United States, the American crocodile is found only in southern peninsular Florida. Because of its similarity to the crocodile, the USFWS regulates the legal trade in alligator skins, or products made from them, to protect the crocodile, whose skin is similar in appearance, but illegal in the commercial market.

4.2 BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS)*

Status
The bald eagle is protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The eagle was removed from the endangered species list in 2007, but is currently undergoing five years of monitoring to confirm the revised status. Its status is Federally classified as "Delisted Taxon-Recovered" in Louisiana.

Species, Habitat, and Distribution
The bald eagle is the only species of sea eagle native to North America. Adults are black with a snow-white head and tail. Sub adults are mottled brown and black and lack the distinctive white head and tail. Wingspan is 6 to 7 feet with females weighing between 10-14 lbs. and males weighing between 8-10 lbs.

Bald eagles nest in Louisiana from October through mid-May, primarily in cypress snags in swamps or near fresh to intermediate marshes or open water in the southeastern parishes. Bald eagles will often return to the same nest for a number of years; however, they may also use alternate nests within the vicinity. Shoreline trees that provide a clear view of the water to locate aquatic prey are often chosen as nest sites. Bald eagles primarily feed on fish, but are opportunistic and will eat a variety of mammals, amphibians, crustaceans, and birds. Wintering habitat used by bald eagles in Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl.

Management and Protection
According to The USFWS National Bald Eagle Management Guidelines, the proposed action would fall under "Category A," which includes construction of roads, trails, canals, power lines, and other linear activities, and alteration of shorelines or wetlands. Table 1 provides the guidelines for activities in Category A.

Table 1. Closest distances activities in Category A should be conducted relative to the location of a bald eagle nest.

Visibility	If there is no similar activity within 1 mile of the nest	If there is similar activity closer than 1 mile from the nest
If the activity will be visible from the nest	660 feet. Landscape buffers are recommended	660 feet, or as close as existing tolerated activity for similar scope. Landscape buffers are recommended.
If the activity will not be visible from the nest	330 feet. Clearing, external construction, and landscaping between 330 feet and 660 feet should be done outside breeding season.	330 feet, or as close as existing tolerated activity of similar scope. Clearing, external construction, and landscaping within 660 feet should be done outside breeding season

Source, USFWS, 2007.

4.3 GULF STURGEON (*ACIPENSER OXYRHYNCHUS DESOTOI*)

Status
On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act, and the USFWS designated critical habitat for this species throughout its range on February 28, 2003. In Louisiana, Gulf sturgeon critical habitat includes the Pearl River System in Washington and St. Tammany Parishes, the Bogue Chitto River, as well as Lake Pontchartrain, Lake Borgne, Lake Catherine, and the Rigolets.

Species, Habitat, and Distribution
The Gulf sturgeon, also known as the Gulf of Mexico sturgeon, is an anadromous fish (i.e. a fish that breeds in freshwater after migrating from marine or estuarine environments). The Gulf sturgeon inhabits coastal rivers from Louisiana to Florida during spring and summer, and the estuaries, bays, and marine environments of the Gulf of Mexico during fall and winter. It is a nearly cylindrical, primitive fish embedded with bony plates or scutes. The head ends in a hard, extended snout; the mouth is inferior and protrusible and is preceded by four conspicuous barbels. The tail (caudal fin) is distinctly asymmetrical; the upper lobe is longer than the lower lobe (heterocercal). Adults range from 4 to 8 feet (1.2 to 2.4 meters) in length; adult females are larger than adult males.

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years of age (Huff, 1975). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff, 1975). In the spring (from late February to mid-April), when the river surface temperatures are 63 to 70 degrees Fahrenheit (ºF) (17 to 21 degrees Celsius [ºC]), sexually mature males and females migrate into rivers to spawn. It is believed that Gulf sturgeon exhibit a spawning periodicity similar to Atlantic sturgeon, with females spawning at intervals ranging from every 3 to 5 years, and males every 1 to 5 years.

Gulf sturgeon eggs are demersal (i.e. they sink to the bottom), adhesive, and vary in color from gray to brown to black (Vladykov and Greeley, 1963; Huff, 1975; Parauka et al., 1991). Sturgeon require hard substrates for eggs to adhere to and to provide shelter for developing larvae. Young-of-the-year Gulf sturgeon appear to disperse widely, using extensive portions of the river as nursery habitat. They are typically found on sandbars and sand shoals over rippled bottom and in shallow, relatively open, unstructured areas.

Gulf sturgeon feeding habits in fresh water vary depending on the fish's life history stage. Young-of-the-year Gulf sturgeon remain in fresh water feeding on aquatic invertebrates and detritus approximately 10 to 12 months after spawning occurs (Mason and Clugston, 1993. Juveniles less than 11 lbs (5 kg) are believed to forage extensively and exploit scarce food resources throughout the river, including aquatic insects (e.g., mayflies and caddis flies), worms (oligochaetes), and bivalve mollusks (Huff, 1975; Mason and Clugston, 1993). Subadults (age 6 to sexual maturity) and adults (sexually mature) feed only in marine and estuarine habitats and are thought to forage opportunistically (Huff, 1975) on primarily benthic (bottom dwelling) invertebrates. Gut content analyses have indicated that, at this life stage, the Gulf sturgeon's diet is predominantly amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, mollusks, and crustaceans (Huff, 1975; Mason and Clugston, 1993; Fox et al., 2000 and 2002, see http://www.fws.gov).

When river temperatures drop in the fall to about 63 to 72°F (17 to 22°C), Gulf sturgeon return to the coastal shelf areas of the Gulf of Mexico. Most subadult and adult Gulf sturgeon spend the cooler months (October or November through March or April) in estuarine areas, bays, or the Gulf of Mexico feeding (Odenkirk, 1989; Foster, 1993; Clugston et al., 1995; Fox et al., 2002, see http://www.fws.gov). Winter habitats used by Gulf sturgeon coincide with the habitats of their prey. Along the Mississippi Sound barrier islands, Gulf sturgeon habitat typically consists of sandy substrates with an average depth of 6.2 to 19.4 ft (1.9 to 5.9 m).

Historically, the Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi, east to the Suwannee River in Florida, with infrequent sightings occurring west of the Mississippi River.
Gulf sturgeon numbers declined due to over fishing throughout most of the 20th century. After 1950, the decline was exacerbated by habitat loss associated with the construction of water control structures such as dams and sills (submerged ridges or vertical walls of relatively shallow depth separating two bodies of water). In several rivers throughout the species' range, dams have severely restricted sturgeon access to historic migration routes and spawning areas (Boschung, 1976; Wooley and Crateau, 1985; McDowall, 1988). Gulf sturgeon exhibit a high degree of fidelity, with over 99 percent returning to spawn in the same river system in which they were hatched (U.S. Army Corps of Engineers [USACE], 2006).

The majority of recent Gulf sturgeon sightings in the Pearl River drainage have occurred downstream of the Pools Bluff Sill near Bogalusa, Louisiana, and downstream of the Bogue Chitto Sill on the Bogue Chitto River in St. Tammany Parish, Louisiana. Between 1992 and 1996, 257 Gulf sturgeon were captured from the Pearl River system (West Middle River, Bogue Chitto River, East Pearl River, and West Pearl River). The subpopulation in that system was estimated at 292 fish, of which only 2 to 3

percent were adults (Morrow et al., 1998, see http://www.fws.gov). The annual mortality rate was calculated to be 25 percent.

In contrast, preliminary results from Pearl River captures between 1992 and 2001 suggest a stable subpopulation of 430 fish, with approximately 300 adults (Rogillio et al., 2007, see http://www.fws.gov). Morrow et al. (1999 see http://www.fws.gov) suggested that the Pearl River Gulf sturgeon population would be self-sustaining if the number of adults was at least 100, recruitment was satisfactory, and annual mortality was less than about 15 percent. Based on those criteria and from data gathered during 2000 and 2001, it appears that the population is at least self-sustaining and may even be recovering. There may be as many as 300 adults. While mortality estimates may be somewhat biased, the rate is probably about half of the 15 percent deemed to be a minimum acceptable benchmark.

Management and Protection
Life history characteristics of Gulf sturgeon may complicate and protract recovery efforts. Gulf sturgeon cannot establish a breeding population rapidly because of the amount of time it takes them to reach sexual maturity. Further, Gulf sturgeon appear to be river-specific spawners, although immature Gulf sturgeon occasionally exhibit plasticity in movement from one river to another. Therefore, natural repopulation by Gulf sturgeon migrating from other rivers may be non-existent or very low.

The take of Gulf sturgeon is prohibited in the state waters of Louisiana, Mississippi, Alabama, and Florida. Through agreements reached under Section 6(a) of the ESA, the states are authorized: 1) to conduct investigations to determine the status and requirements for survival of resident species of fish and wildlife (this may include candidate species for listing), and 2) to establish programs, including acquisition of land or aquatic habitat or interests for the conservation of fish and wildlife.

4.4 WEST INDIAN MANATEE (*TRICHECHUS MANATUS*)

Status
The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies in 1967, and received Federal protection with the passage of the ESA in 1973. Critical habitat was designated in 1976, 1994, 1998, 2002, and 2003 for the Florida subspecies.

Species and Habitat Description
The West Indian manatee is a large gray or brown aquatic mammal. Adults average approximately 10 feet (3 m) in length and weigh up to 2,200 pounds (999 kg). They have no hind limbs, and their forelimbs are modified as flippers. Manatee tails are flattened horizontally and rounded. Their body is covered with sparse hairs and their muzzles with stiff whiskers (USFWS, 2001c). The nostrils, located on the upper snout, open and close by means of muscular valves as the animal surfaces and dives (Husar, 1977; Hartman, 1979). Manatees will consume any aquatic vegetation (i.e., submerged, floating, and emergent) available to them and sometimes even shoreline vegetation. Although primarily herbivorous, they occasionally feed on fish. Manatees may spend about five hours a day feeding, and may consume four to nine percent of their body weight per day.

Observations of mating herds indicate that females mate with a number of males during their 2- to 4-week estrus period; pregnancy is estimated to last 12 to 14 months (O'Shea et al., 1992). Births occur year-round with a slight drop during winter months. Manatee cows usually bear a single calf, but 1.5 percent of births are twins. Calves reach sexual maturity at three to six years of age. Mature females may give birth every two to five years (USFWS, 2001c).

Manatees inhabit both salt and fresh water of sufficient depth (5 feet [1.5 m] to usually less than 20 feet [6.1 m]) throughout their range. Shallow grassbeds with ready access to deep channels are preferred

feeding areas in coastal and riverine habitats (USFWS, 2001c). They may also be encountered in canals, rivers, estuarine habitats, saltwater bays, and have been observed as much as 3.7 miles (6.0 km) off the Florida Gulf Coast. Between October and April, Florida manatees concentrate in areas of warmer water. Severe cold fronts have been known to kill manatees when the animals did not have access to warm water refuges. During warmer months, they appear to choose areas based on an adequate food supply, water depth, and proximity to fresh water. Manatees may not need fresh water, but they are frequently observed drinking water from hoses, sewage outfalls, and culverts.

During winter months, the United States' manatee population is confined to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. Power plant and paper mill outfalls create most of the artificial warm water refuges utilized by manatees. During summer months, they migrate as far north as coastal Virginia on the east coast and the Louisiana coast in the Gulf of Mexico.

During summer months, manatees disperse from winter aggregation areas, and are commonly found almost anywhere in Florida where water depths and access channels are greater than 3.3 to 6.6 feet (1.0 to 2.0 m) (O'Shea, 1988). In the warmer months, manatees usually occur alone or in pairs, although interacting groups of five to ten animals are not unusual (USFWS 2001c).

In the early 1980s, scientists tried to develop procedures for estimating the overall manatee population in the southeastern United States (USFWS, 2001c). The best estimate throughout the State of Florida was 1,200 manatees (Reynolds and Wilcox, 1987). In the early 1990s, the State of Florida initiated a statewide aerial survey in potential winter habitats during periods of severe cold weather (Ackerman, 1995), and the highest count of 3,276 manatees was recorded in January 2001.

Management and Protection
The most significant problem faced by manatees in Florida is death or injury from boat strikes (USFWS, 2001c). Minimum flows and levels for warm water refuges need to be established to ensure their long-term availability for manatees. Their survival will depend on maintaining the ecosystems and habitat sufficient to support a viable manatee population (USFWS, 2001c). The focus of recovery is on implementing, monitoring, and addressing the effectiveness of conservation measures to reduce or remove threats that will lead to a healthy and self-sustaining population (USFWS, 2001c).

The West Indian manatee is also protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA establishes a national policy for the maintenance of health and stability of marine ecosystems and for obtaining and maintaining optimum sustainable populations of marine mammals. It includes a moratorium on the taking of marine mammals. The recovery planning under the ESA includes conservation planning under the MMPA (USFWS, 2001c).

5.0 DETERMINATION OF EFFECTS OF THE PROPOSED ACTION

The potential exists that the protected species in the study area may be present during proposed construction activities. However, while individuals may be affected, whole populations would not be adversely affected by implementation of the proposed action.

5.1 AMERICAN ALLIGATOR

The American alligator is a commonly encountered resident of the ARDC study area. The project is unlikely to result in any damage to individuals, who are easily capable of avoiding the construction taking place along the ARDC. The scope of activities constitutes a Not Likely to Adversely Affect determination for the species and its critical habitat.

5.2 BALD EAGLE

The design of the proposed action was amended to avoid any construction within 660 feet of the known location of a bald eagle nest. Therefore, scope of activities constitutes a Not Likely to Adversely Affect determination for the species and its critical habitat.

5.3 GULF STURGEON

The proposed action would involve activities outside the critical habitat of the Gulf sturgeon. Potential project-induced impacts, however unlikely, may result from incidental interaction with the Gulf sturgeon during the excavation for the construction of gaps in the dredged material banks of the ARDC. The scope of activities constitutes a Not Likely to Adversely Affect determination for the species and its critical habitat.

5.4 WEST INDIAN MANATEE

Sightings of the West Indian manatee in Louisiana have occurred in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, Mississippi River Gulf Outlet (MRGO), and in canals within the adjacent coastal marshes of Louisiana. However, there is no known population thriving in the State. On July 9, 2001, a manatee was observed passing safely through the Inner Harbor Navigation Canal (IHNC) Lock and into the Mississippi River. Should any manatees be encountered during the proposed activities, an on-board observer would notify the proper personnel, and harmful activities (e.g., dredging) would be temporarily suspended until the animal(s) moves out of the area of operations. Any disturbance to the manatee would only be temporary during construction activities, and would result in temporary displacement. The manatees would likely move and relocate to other nearby areas for foraging or resting purposes. The scope of activities constitutes a Not Likely to Adversely Affect determination for the species and its critical habitat.

Because the West Indian manatee may occur in the project vicinity, the Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. The Contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of construction activities not conducted in accordance with these specifications.

a. Special Operating Conditions <u>If Manatees Are Present</u> in the Project Area

(1) If a manatee(s) is sighted within 100 yards (91 m) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 ft (15.2 m) of a manatee. If a manatee is closer than 50 ft (15.2 m) to moving equipment or the project area, the equipment will be shut down and all construction activities will cease to ensure protection of the manatee.

Construction activities will not resume until the manatee has departed and the 50-foot (15.2 m) buffer has been re-established.

(2) If a manatee(s) is sighted in the project area, all vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot (1.2 m) clearance from the bottom, and vessels will follow routes of deep water

whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits.

(3) If siltation barriers are used, they will be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment.

(4) Manatee Signs. Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2" x 11" (21.6 x 27.9 cm) reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' (0.9 x 1.2 m) sign reading "CAUTION: MANATEE AREA" will be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2" x 11" (21.6 x 27.9 cm) reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUT DOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" will be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction.

b. Manatee Sighting Reports

Any sightings of manatees, or collisions with a manatee, will be reported immediately to the Corps of Engineers. The point of contact within the USACE will be Edward Creef, (504) 862-2521, FAX (504) 862-2317.

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Appendix B

U.S. FISH AND WILDLIFE SERVICE COORDINATION LETTERS AND REPORT

Coordination Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

DEPT. OF NATURAL RESOURCES

October 15, 2008

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OFFICE OF THE SECRETARY

Mr. Scott Angelle, Secretary
Louisiana Department of Natural Resources
Office of Coastal Protection and Restoration
Post Office Box 44487
Baton Rouge, Louisiana 70804

Dear Mr. Angelle:

The U.S. Fish and Wildlife Service (Service) has reviewed the State of Louisiana, Office of Coastal Protection and Restoration's (OCPR) Draft Interim Feasibility Study (Interim Report) for the "Amite River Diversion Canal Modification, Louisiana Coastal Area, Project and Program Support." The Amite River Diversion Canal Modification project was identified in the 2004, Louisiana Coastal Area Ecosystem Restoration Study (LCA Plan) as a near-term critical restoration project, and the purpose of the interim report is to identify changes in the study area, confirm project justification, and describe a path forward to complete a subsequent feasibility study by December 2010. The Interim Report has been prepared under the provisions of the Water Resources Development Act of 2007 and satisfies the requirements of the Secretary of the Army to submit a decision document for that project to Congress by December 31, 2008. The Service submits the following technical assistance in accordance with the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The interim report is well written, provides a good description of the existing conditions and the need for the project, and identifies potential problems and opportunities to be addressed in the subsequent feasibility report. Material excavated during the construction of the Amite River Diversion Canal, a 10.6-mile-long federal flood control canal, was deposited along the canal sides further disrupting the natural hydrologic regime of the swamp complex. Working with two other near-term critical features of the LCA Plan (i.e., the Hope Canal and the Convent/Blind River diversion projects), this project will help restore Mississippi River water, sediment, and nutrients flows into the swamp habitat. Efforts to gap the spoil bank and restore some hydrology in the study area have been implemented as compensatory mitigation for a proposed waterfront development expansion project (reference Corps Permit # MVN 2006-1355 CZ). That project constructed two gaps along the southern spoil bank. The Amite River Diversion Canal Modification project is evaluating the construction of upwards of ten gaps which

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would be strategically placed based on hydrologic modeling and geotechnical investigations to ensure the greatest ecological benefits. The Service recommends that avoidance and minimization of impacts to forested habitat be considered when determining alternative locations for gaps.

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. Should the proposed project involve activity in the aquatic environment in those areas during summer months, further consultation with this office will be necessary.

The Gulf sturgeon (Acipenser oxyrhynchus desotoi), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Portions of the Pearl and Bogue Chitto Rivers, Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne within Louisiana were included in that designation. While sturgeon have been documented in project area waterways, these waterways are not designated critical habitat.

The project-area forested wetlands may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern Parishes. Areas with high numbers of nests include the Lake Verret Basin south to Houma, the marsh/ridge complex south of Houma to Bayou Vista, the north shore of Lake Pontchartrain, and the Lake Salvador area. Eagles also winter, and infrequently nest, in mature pine trees near large lakes in central and northern Louisiana. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that may weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water or area where the eagles usually forage. Shoreline trees or snags located near large waterbodies provide the visibility and accessibility needed to locate aquatic prey. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the BGEPA. The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at: <http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf>. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404/679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting such consultations. Should you need further assistance interpreting the guidelines or performing an on-line project evaluation, please contact this office.

The proposed study area is known to support colonial nesting waterbirds. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary

within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

As you are aware, the Maurepas Swamp Wildlife Management Area (WMA) is located adjacent to the southwestern boundary of the study area along the Petite Amite River. Please contact the LDWF, Region 7 Office (225/765-2360), for further information regarding any additional permits that may be required to perform work on that WMA.

We look forward to assisting the OCPR and the U.S. Army Corps of Engineers in the documentation of existing conditions, development of alternatives, and assessment of effects of project alternatives on Federal trust resources during the subsequent feasibility study. Should you have any questions regarding our comments, please contact Angela Trahan (337/291-3137) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: Corps of Engineers, New Orleans, LA (Attn: Susan Hennington)
NMFS, Baton Rouge, LA
EPA, Baton Rouge, LA
LDWF, Baton Rouge, LA
LDWF, Region 7 Office, Baton Rouge, LA
LDNR, CMD, Baton Rouge, LA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

January 20, 2009

Colonel Alvin B. Lee
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee:

The U.S. Fish and Wildlife Service (Service) has reviewed the Department of the Army, Corps of Engineers (Corps), Notice of Intent (NOI) to prepare a Draft Supplemental Environmental Impact Statement (SEIS) for the Louisiana Coastal Area (LCA) – Louisiana, Amite River Diversion Canal Modification Feasibility Study. The NOI was published in the Federal Register (Volume 73, No. 246, pg. 78340) on December 22, 2008 (Department of Interior No. FR 09/25). The LCA Program was authorized by the Water Resources Development Act of 2007, and this SEIS will be tiered off the programmatic EIS (LCA – Louisiana, Ecosystem Restoration study, November 2004) for that program. The Service submits the following comments in accordance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321 et seq.), the Migratory Bird Treaty Act (MBTA, 40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). These comments were also provided to the State of Louisiana in an October 15, 2008, letter.

Material excavated during the construction of the Amite River Diversion Canal, a 10.6-mile-long federal flood control canal, was deposited along the canal sides further disrupting the natural hydrologic regime of the swamp complex. Working with two other near-term critical features of the LCA Program (i.e., the Hope Canal and the Convent/Blind River diversion projects), this project will help restore Mississippi River water, sediment, and nutrients flows into the swamp habitat. Efforts to gap the spoil bank and restore some hydrology in the study area have been implemented as compensatory mitigation for a proposed waterfront development expansion project (reference Corps Permit # MVN 2006-1355 CZ). That project constructed two gaps along the southern spoil bank. The Amite River Diversion Canal Modification project is evaluating the construction of upwards of ten gaps which would be strategically placed based on hydrologic modeling and geotechnical investigations to ensure the greatest ecological benefits. The Service recommends that avoidance and minimization of impacts to forested habitat be considered when determining alternative locations for gaps.

TAKE PRIDE IN AMERICA

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. Should the proposed project involve activity in the aquatic environment in those areas during summer months, further consultation with this office will be necessary.

The Gulf sturgeon (Acipenser oxyrhynchus desotoi), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Portions of the Pearl and Bogue Chitto Rivers, Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne within Louisiana were included in that designation. While sturgeon have been documented in project area waterways, these waterways are not designated critical habitat.

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Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important

alternative bald eagle nest sites. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that may weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water or area where the eagles usually forage. Shoreline trees or snags located near large waterbodies provide the visibility and accessibility needed to locate aquatic prey. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

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The proposed study area is known to support colonial nesting waterbirds. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

As you are aware, the Maurepas Swamp Wildlife Management Area (WMA) is located adjacent to the southwestern boundary of the study area along the Petite Amite River. Please contact the LDWF, Region 7 Office (225/765-2360), for further information regarding any additional permits that may be required to perform work on that WMA.

The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments.

The Service's Mitigation Policy (Federal Register Volume 46, No. 15, January 23, 1981) supports and adopts this definition of mitigation and considers its specific elements to represent the desirable sequence of steps in the mitigation planning process. That policy identifies four resource categories that are used to insure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value for fish and wildlife and the relative scarcity of the forested wetlands, those wetlands have been designated Resource Category 2 habitats. The mitigation goal for habitats in this resource category is no net loss of in-kind habitat value. Detailed mitigation needs will be evaluated during the feasibility stage.

We look forward to assisting the Corps in the documentation of existing conditions, development of alternatives, and assessment of effects of project alternatives on Federal trust resources during the subsequent feasibility study. Should you have any questions regarding our comments, please contact Angela Trahan (337/291-3137) of this office.

Sincerely,

for James F. Boggs
Supervisor
Louisiana Field Office

cc: DOI, OEPC, Washington, D.C. (Attn.: Loretta Sutton)
DOI, OEPC, Albuquerque, NM (Attn.: Steven Spencer)
FWS, BAP & HC (ERT), Arlington, VA (Attn.: Stephanie Nash)
FWS, Atlanta, GA (Attn.: Richard Warner)
EPA, Dallas, TX
NMFS, Baton Rouge, LA
Corps, New Orleans, LA (Attn.: Mr. Bill Klein, CEMVN-PM-RS)
LDWF, Region 7 Office, Baton Rouge, LA
LDWF, Baton Rouge, LA (Attn.: Kyle Balkum)
LDWF, Natural Heritage Program, Baton Rouge, LA
OCPR, Baton Rouge, LA

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United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER 10/479
File 9043.1

June 29, 2010

Joan Exnicios
Chief, Environmental Planning & Compliance Branch
New Orleans District
U.S. Army Corps of Engineers
PO Box 60267
New Orleans, Louisiana 70160-0267

Subject: Draft Supplemental Environmental Impact Statement (DSEIS) for Amite River Diversion Canal (ARDC) Modification Element of the Section 7006(E)(3) Ecosystem Restoration Project, Feasibility Study, Louisiana Coastal Area (LCA), Ascension and Livingston Parishes, LA

Dear Ms. Exnicios:

The U.S. Department of the Interior has reviewed the subject document and offers the following comments in accordance with provisions of the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and the Endangered Species Act of 1973 (87 Stat. 884, as amended, 16 U.S.C. 1531 et seq.).

General Comments on the DSEIS

The DSEIS provides a good description of fish and wildlife resources within the study area, the purpose and need for the proposed action, program objectives, critical needs and opportunities, and potential risks and uncertainties. Given the substantial adverse impacts to the project area wetlands and their associated fish and wildlife resources that are expected to occur under future-without-project conditions, the U.S. Fish and Wildlife Service strongly supports authorization and implementation of the ARDC project, as it would improve environmental conditions through the creation and/or restoration of swamp habitats. Specifically, the LCA-ARDC project is designed to establish hydrologic connectivity between the ARDC and the western Maurepas Swamp. That connectivity would allow the swamp to drain during seasonal low-flow conditions in the Amite River, and thereby, promote the germination and survival of bald cypress (and other tree species) seedlings. In addition, nutrients and sediments would be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events.

Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat degradation and swamp loss via conversion to open water.

The FWS's Lafayette Field Office supports implementation of the proposed project and provided the following fish and wildlife recommendations in our April 2010 Draft FWCA Report:

1. If authorized funding limits for this project are increased the FWS recommends that Alterative 39 be reconsidered as the potential future Tentatively Selected Plan (TSP).

2. If a proposed project feature is changed significantly or is not implemented within one year of the Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with our office to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their critical habitat.

3. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. A qualified biologist should inspect the proposed work site for the presence of undocumented wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies, and October through mid-May for bald eagles).

4. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

5. Because bald eagles are known to nest within the proposed study area, we recommend that an evaluation be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary and those results should be forwarded to this office.

6. Land clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

7. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the FWS and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

8. A report documenting the status of implementation, maintenance and adaptive management measures should be prepared every 3 years by the managing agency and provided to the Corps, the FWS, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Office of Coastal Protection and Restoration, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

Specific comments on the SEIS

Page ES-xv, ES.10 Conclusions and Recommendations, Paragraph 1, Sentence 1 – This sentence should read ". . . includes the creation of three conveyance channels. . ."

Page 3-9, Table 3.1 Evaluation of Hydrologic Subunits, SE-2 Description – This section states that although the swamps within SE-2 are hydrologically connected to the Blind River, this area would benefit from additional freshwater, nutrients, and sediments, as well as flushing of severe saltwater intrusion events. The FWS recommends describing why such benefits are not currently being realized (from the existing hydrologic connection to the Blind River) and how additional benefits would be derived from connecting the area to the ARDC.

Page 3-16, Table 3.2 Management Measures Considered with Screening Results, CS-01 Clearing and Snagging of Bayou Chene Blanc NE-1/NW-2 – The screening result identified does not address clearing and snagging activities, but rather dredging activities. The FWS, therefore, recommends revising accordingly.

Page 3-72, Section 3.7 Plan Selection – Tentatively Selected Plan – Table 3.11 depicts the Project Delivery Team's (PDT) ranking of the Final Array of Alternatives. Because the PDT ranked Alternatives 39, 36, and 38 higher than Alternative 33, we recommend justifying why Alternative 33 was selected as the TSP over those higher ranked alternatives.

Page 3-90, Performance Measures for Monitoring, Performance Measure 2b: Number of cypress and tupelo saplings – Both cypress and tupelo are shade intolerant. The desired outcome should be revised to accurately depict the limits of this performance measure. Performance of this measure is dependent on achieving historic hydrologic patterns (extended dry periods) in the swamp and would be more probable in areas that allow sufficient light (i.e., deteriorated swamp habitats that are converting to marsh/open water). Conversely, achievement of this measure is unlikely in healthier portions of the project area.

Page 4-2, Section 4.1.2 Climate, Paragraph 2, Sentence 6 – This sentence should read "Minimum and maximum annual rainfall values for Reserve were reported as 34.1 and 84.3 inches, respectively."

Page 5-1, Section 5.0 Environmental Consequences – The FWS recommends addressing direct, indirect, and cumulative impacts of the proposed project to the bald eagle and colonial nesting wading birds in this section. In addition, we recommend including a discussion on how potential adverse impacts to those species will be avoided.

Comments on the BA

The Gulf sturgeon is an anadromous fish that occurs in many coastal rivers and streams and estuarine waters from the Atchafalaya River to the Suwanee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, and rivers and lakes of the Lake Pontchartrain basin and adjacent estuarine areas. The proposed project does not occur within Gulf sturgeon critical habitat and that species has not been reported within the ARDC. Furthermore, while there may be minor impacts to Gulf sturgeon prey species those impacts are expected to be insignificant since only a small fraction of the total ARDC water bottom would be impacted. Thus, the FWS's Louisiana Field Office concurs with your determination that the proposed activity is not likely to adversely affect the Gulf sturgeon or its critical habitat.

Federally listed as endangered, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, including their associated coastal waters and streams, during the summer months. Manatees, within Louisiana, have also been reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes, they have also been occasionally observed elsewhere along the Louisiana coast. According to your BA, all contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area). In addition, siltation barriers, if used, would be made of material in which manatees cannot become entangled, and would be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Accordingly, the FWS's Louisiana Field Office concurs with your determination that the proposed work is not likely to adversely affect the West Indian manatee.

No further endangered species consultation will be required for this project unless there are changes in the scope or location of the work, or construction has not been initiated within 1 year. If the work has not been initiated within 1 year, follow-up consultation should be accomplished with the FWS's Louisiana Field Office prior to making expenditures for construction.

We appreciate the opportunity to provide comments on the subject document. If your staff has additional questions regarding our comments, please contact FWS's Lafayette Field Office Karen Soileau at (337) 291-3132.

Sincerely,



Stephen R. Spencer
Regional Environmental Officer

cc: U.S. Environmental Protection Agency, Dallas, TX
Attn: Barbara Keeler
NOAA's National Marine Fisheries Service, Baton Rouge, LA
Attn: Mr. Richard Hartman
Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA
Attn: Mr. Kyle Balkum
Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge, LA
Louisiana Office of Coastal Protection and Restoration, Baton Rouge, LA
Attn: Renee Sanders

Coordination Act Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

April 12, 2010

Colonel Alvin B. Lee
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee

Please reference the "Louisiana Coastal Area – Amite River Diversion Canal Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study". This report contains a description of existing fish and wildlife resources in the project area, discusses future with-project and future without-project habitat conditions, identifies fish and wildlife-related impacts, and provides project recommendations. This document does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Service is coordinating with National Marine Fisheries and the Louisiana Department of Wildlife and Fisheries; their comments will be incorporated into the final report.

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Ms. Karen Soileau (337/291-3132) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Attachment

cc: EPA, Dallas, TX
National Marine Fisheries Service, Baton Rouge, LA
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
Office of Coastal Protection and Restoration, Baton Rouge, LA
GEC, Baton Rouge, LA

TAKE PRIDE IN AMERICA

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DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT

ON

LOUISIANA COASTAL AREA - AMITE RIVER DIVERSION CANAL MODIFICATION ELEMENT OF THE SECTION 7006(E)(3) ECOSYSTEM RESTORATION PROJECTS STUDY

Submitted To
New Orleans District
U.S. Army Corps of Engineers
and
Office of Coastal Protection and Restoartion

Prepared by
Karen Soileau
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services
Lafayette, Louisiana

April 2010

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INTRODUCTION

The Louisiana Coastal Area – Amite River Diversion Canal (LCA-ARDC) Modification Integrated Feasibility Report and Environmental Impact Statement (EIS) was prepared by the U.S. Army Corps of Engineers (USACE), New Orleans District, in partnership with the Louisiana Office of Coastal Protection and Restoration, under the authority of Title VII of the Water Resources Development Act (WRDA) of 2007. This authorization was recommended by the Chief of Engineer's Report, dated January 31, 2005. That report recommended projects and features in the interest of hurricane protection, prevention of salt water intrusion, preservation of fish and wildlife, prevention of erosion, and related water resources purposes. One recommended project was the modification of the ARDC.

The LCA-ARDC project is designed to establish hydrologic connectivity between the ARDC and the western Maurepas Swamp. That connectivity would allow the swamp to drain during seasonal low-flow conditions in the Amite River, and thereby, promote the germination and survival of bald cypress (and other tree species) seedlings. In addition, nutrients and sediments would be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events. Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat degradation and swamp loss via conversion to open water.

This draft report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed restoration measures. When finalized, this report will be submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (FWCA; 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and will constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act. This draft FWCA Report is being provided to the Louisiana Department of Wildlife and Fisheries (LDWF) and the National Marine Fisheries Service (NMFS); their comments will be incorporated into the final report.

DESCRIPTION OF THE STUDY AREA

In the 1950s, the USACE, in an effort to relieve flooding along the upper Amite River, constructed the ARDC in order to facilitate the flow of water from the Amite River to Lake Maurepas. The 10 mile long canal is 350 feet wide and was dug to a depth of -25 feet. The LCA-ARDC study area (Figure 1) is located in LCA Subprovince 1 (USACE 2004) and is situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal.

Historically, hydrologic conditions within the LCA-ARDC study area were dominated in the

north and west by the Amite River, in the south by overbank flow from the Mississippi River, and in the east by tidal influence from Lake Maurepas. Periodic flooding of the Amite River and/or Mississippi River resulted in the inundation of the study area. Flooding occurred annually, with peak water elevations in the spring or early summer. As floodwaters receded, surface waters in the study area were conveyed eastward via sheet flow to Bayou Chene Blanc or Blind River, then to Lake Maurepas.

The construction of flood control projects within the LCA-ARDC study area, primarily the ARDC component of the Amite River and Tributaries (AR&T) project, together with other land use practices, such as land development and logging, have significantly altered the hydrologic regime of the study area. River channelization and levee construction reduced overbank flooding in the study area, which in turn reduced the influx of floodwaters bearing high volumes of nutrients and sediment that are essential for biomass production and soil accretion. In addition, the placement of dredged material as berms along either side of the ARDC disrupted sheet flow within the LCA-ARDC study area and formed topographic high points (ridges) that prevented the drainage of bald cypress-tupelo swamps into the ARDC during low surface flow intervals (USACE 2004). This activity, in conjunction with other activities, such as construction of the railroad grade that traverses the eastern study area from north to south, permanently impounded bald cypress-tupelo swamp habitat within the study area. Those impoundments have contributed to decreased water quality and increased cypress and tupelo seedling mortality, which has resulted in increased habitat conversion from cypress swamp to open water.

Impoundment is particularly pronounced within the eastern portion of the LCA-ARDC study area, i.e., NE-1 and NE-2 (Figure 1). Specifically, during a recent study, water levels within the swamp habitat along the left descending bank of the ARDC never receded below 2.2 feet above mean sea level (msl), although canal water levels receded below that level (Shaffer *et al.,* 2006). Swamp impoundment is not as evident within the western portion of the LCA-ARDC study area. Installation of drainage culverts, construction of several gaps in the dredge material berms, and the confluence of Bayou Pierre with the ARDC in that area provide for hydrologic exchange between the diversion canal and the adjacent swamps.

Subsidence and salinity increases have also contributed to swamp ecosystem degradation in the LCA-ARDC study area. Land elevations decrease from subsidence, which may be caused by compaction, oxidation, and consolidation of sediments, faulting, groundwater depletion, or decreased organic deposition as a result of decreased vegetation biomass production; while land elevations increase as a result of sediment accretion, from direct sediment input from riverine sources or from organic vegetation deposition. The soil characteristics of the western Maurepas Swamp indicate a lack of riverine influence as evidenced by high soil organic matter content and low bulk density values (DeLaune et al. 1979, Hatton 1983, Messina and Conner 1998). Consequently, soil building within the Maurepas Swamp is almost exclusively a result of organic productivity (Shaffer et al. 2001, 2003, 2006, Rybczyk et al. 2002, Roberts 1985). In the swamps adjacent to the ARDC, productivity is substantially depressed compared to normal conditions (Coastal Wetlands Planning, Protection and Restoration Act [CWPPRA] Task Force

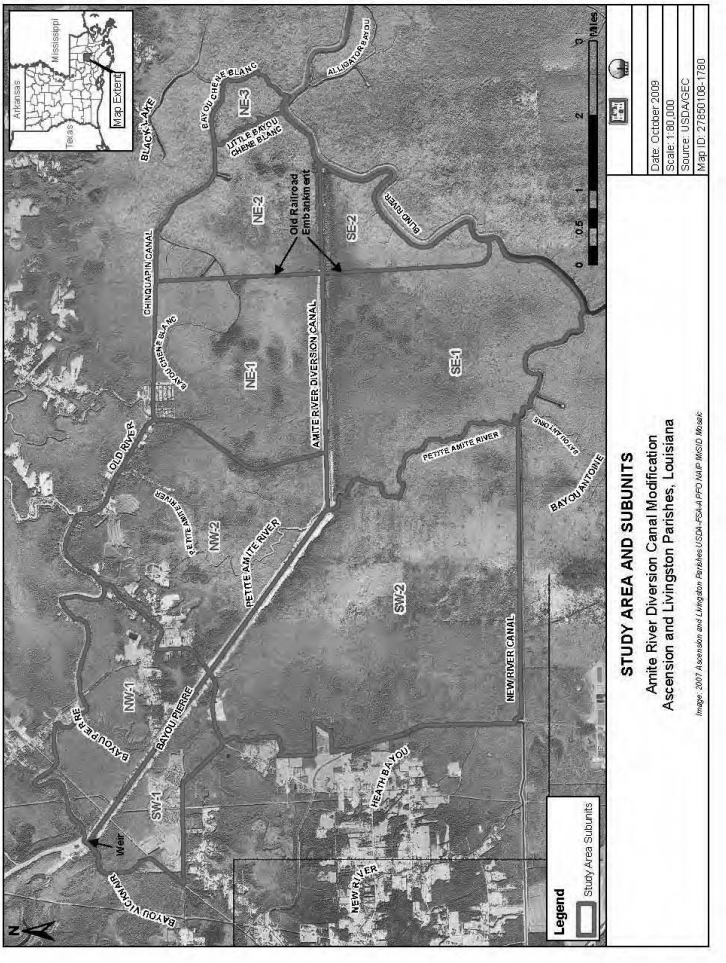


Figure 1. Study Area and Subunits

2002). Subsidence in the LCA-ARDC study area and vicinity is classified as intermediate, at about 1.1-2.0 feet per century (LCA 2004). With minimal soil building and moderately high subsidence, there has been a net lowering of ground surface elevation, doubling flood frequency over the last four decades (Thompson 2000), so that the swamps are now persistently flooded.

Saltwater intrusion has increased in this general area, partly due to net subsidence and the lack of riverine freshwater inputs. Salinities as low as three parts per thousand (ppt) can reduce growth of both bald cypress and water tupelo saplings (Pezeshki et al. 1990). Salinity, combined with flooding stress, can substantially reduce bald cypress growth. Consequently, salinity significantly contributes to swamp deterioration, particularly combined with stressors such as flooding and herbivory.

Storm surges from Lake Maurepas caused by tropical cyclones also exert a stochastic but severe stress on the swamp habitat through salinity spikes in swamp surface waters. Dredged material berms prevent higher salinity water from being flushed out of the system (CWPPRA Task Force 2002). Storm surge waters remain in the impounded swamps of the LCA-ARDC study area cumulatively increasing salinities in impounded waters and soils.

FISH AND WILDLIFE RESOURCES

The purpose of this section is to describe the principal fish and wildlife resources of the study area, and to establish their significance. Several key habitat types are described, followed by qualitative descriptions of important fish and wildlife.

Major Habitat Types

Cypress/Tupelo Swamps

The LCA-ARDC study area contains approximately 27,984 acres; the majority of which is dominated by bald cypress/tupelo swamp habitat. About 18,204 acres of that habitat type are presently impounded to various extents within the study area; that persistent flooding has resulted in the impairment of cypress/tupelo seedling establishment/regeneration (CWPPRA Task Force 2002). Cypress/tupelo regenerates well when the seedbed is moist but not flooded during the time period of seed germination and seedling establishment. Cypress/tupelo seeds cannot germinate in standing water, and seedlings must grow tall enough during dry periods for their crowns to extend above the water surface to survive flooding during the growing season. Excessive flooding will reduce regeneration even though overstory trees may still be thriving. Ultimately, the lack of regeneration due to prolonged inundation will eliminate forest cover, resulting in the conversion of swamp habitat to open water over time (CWPPRA Task Force 2002). In addition, saltwater intrusion from storm events has stressed the swamp habitat along the Blind River.

Cypress swamps in the project area provide substantial fish and wildlife values. Wildlife species typical of cypress swamps include green tree frog, bullfrog, mud and musk turtles, American alligator, various species of water snakes, anhinga, barred owl, northern parula, great blue heron, great egret, white ibis, and mink. Often surrounding backwater lakes, these areas also provide

essential habitat for aquatic species when inundated.

In addition to bald cypress and water tupelo, Drummond red maple, green ash, and various oak species are also found in the cypress/tupelo swamp habitat within the LCA-ARDC study area, with Drummond red maple and green ash comprising sub-dominant midstory species (Conner and Day 1976; Hoeppner 2008; Shaffer et al. 2003). Scrub species, including black willow, wax myrtle, and common buttonbush are sporadically present, particularly in areas with diminished canopy cover caused by impaired health or mortality of overstory species. Shrub-scrub swamps provide important nesting habitat for colonial wading birds as well as various species of aquatic wildlife.

Bottomland Hardwoods

Bottomland hardwoods are present along several ridge remnants that run through the LCA-ARDC study area. These ridges are mostly near the mid-point of the east-west stretch of the ARDC. Dominant tree species in those areas include Drummond red maple, green ash, laurel oak, water oak, sweet gum, sugarberry, American elm, and Chinese tallow. The areas between the ridges and the swamp show a transition in species including green ash, Drummond red maple, black willow, bald cypress, and water tupelo. Wax myrtle, rough-leaf dogwood, black willow, Chinese tallow, Chinese privet, yaupon, and deciduous holly typically dominate the shrub stratum. Vines such as poison ivy, greenbriars, pepper vine, and trumpet creeper are present. In addition, an old railroad grade and several earthen levees run through the LCA-ARDC study area with similar habitats.

Bottomland hardwood forests typically provide high wildlife habitat values to a variety of species, including amphibians such as the Gulf coast toad and Cope's gray tree frog; reptiles such as the copperhead and green anole; many species of birds, including wood duck, barred owl, pileated woodpecker, red-shouldered hawk, Acadian flycatcher, Swainson's Warbler and northern parula; and mammals including white-tailed deer, swamp rabbit, gray fox, bobcat, raccoon, opossum, and squirrels. In addition to terrestrial wildlife, many species of fish utilize flooded bottomland hardwoods as well; some species are specifically adapted for spawning in these backwater flood plains.

Open Water

Open water areas are distributed throughout the LCA-ARDC study area and include the ARDC; the Amite, Petite Amite, and Blind Rivers; Bayous Pierre and Chene Blanc; and the Choupique Canal. Submerged aquatic vegetation communities within the LCA-ARDC study area are largely confined to areas of higher flow. This includes natural waterways and natural cuts into the swamp interior. Shallow water habitats within the LCA-ARDC study area that have insufficient flow have become choked with floating vegetation, greatly limiting light penetration within the water column.

In their *2006 Water Quality Integrated Report*, the Louisiana Department of Environmental Quality indicated that water within the study area supports the designated standards for primary and secondary contact recreation, but does not support those standards for fish and wildlife

propagation. Suspected sources of impairment include mercury, total phosphorus, chloride, excessive nutrient levels, siltation, and low levels of dissolved oxygen.

Fresh Marsh

There are approximately 249 acres of fresh marsh within the LCA-ARDC study area. Shaffer et al. (2003) have shown that many of the marshes within the Maurepas Swamp exist as a transitional habitat as swamps are converting to open water areas over time. Those swamp habitats are being replaced by marsh and open water due to a number of factors including salt water intrusion (associated with hurricanes and rising sea levels), altered hydrology, impoundments, subsidence, and herbivory (Keddy et al. 2007).

Developed Areas

Developed areas comprise approximately 281 acres within the LCA-ARDC study area. Urban areas are primarily confined to the dredged material berms lining the ARDC adjacent to LA-22, and the right descending bank of the Amite River in the northwestern portion of the LCA-ARDC study area. Barren lands make up a small percentage of the LCA-ARDC study area and may include strip mines, quarries, and gravel pits. Agricultural croplands or grasslands make up approximately 469 acres of the LCA-ARDC study area and appear to be restricted to livestock pasture. These pastures are located in isolated pockets along the lower Amite River and LA-22 in the western portion of the study area.

Fishery Resources

Construction of the ARDC and dredged material berms have impeded exchange of organisms and water between the swamp and the ARDC. Accordingly, the study area is expected to provide low- to moderate-value habitat for some recreationally important fishes and shellfishes. Freshwater sport fishes likely present include white crappie, bluegill, warmouth, channel catfish, and blue catfish. Other fishes likely present include yellow bullhead, freshwater drum, bowfin, carp, buffaloes, and gars. In addition, the waterbodies and wetlands of the LCA-ARDC study area provide nursery and foraging habitats supportive of a variety of fishery species, some of which may serve as prey for other fish species.

Lantz (1970) sampled fish within the Amite River; primarily freshwater species were collected, although a few transient marine species were also collected or reported. Species collected included blue catfish, gizzard shad, spotted gar, freshwater drum, channel catfish, striped mullet, and largemouth bass. Laiche (1980) also sampled fish within the Amite River. The most abundant species collected were blacktail shiner, bullhead minnow, mosquitofish, longear sunfish, mimic shiner, blackstripe topminnow, bluegill, and longnose shiner.

Watson et al. (1981) collected 57 species of fish in the Blind River, including 43 freshwater species, 12 estuarine species, and two diadromous species. The authors suggested the confluence of the ARDC was a point of separation between the upper and lower reaches of Blind River. The lower Blind River had the greatest species diversity, primarily due to the presence of estuarine species. The low concentrations of dissolved oxygen above the ARDC could be an important

limiting factor in the distribution of fish.

Aquatic and wetland habitats in the LCA-ARDC study area also provide foraging and nursery habitat for a few economically important marine fishery species that use freshwater habitats in this area. The species expected to be found in the LCA-ARDC study area include striped mullet and Gulf menhaden.

Wildlife Resources

The coastal marshes and forested wetlands of the Lake Pontchartrain Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture (GCLV): Mississippi River Coastal Wetlands Initiative as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. The Mississippi River Coastal Wetlands Initiative area is dominated by coastal marsh, forested swamps, and seasonally flooded bottomland hardwoods that provide habitat for several species of wintering waterfowl. Wood ducks are the primary waterfowl species in forested wetlands, while other ducks (e.g., mallard, American widgeon, gadwall, blue- and green-winged teal, Northern shovelers, ring-necked ducks, and lesser scaup) use those forested habitats to a lesser degree.

Strategies to achieve the goals and objectives of the GCJV include but are not limited to: 1) maintaining the existing functions and values of those habitats and preventing additional losses and degradation of those wetlands and 2) modifying existing dredged material berms and canals to restore hydrology (Wilson et al. 2002). Numerous other game birds are present in or adjacent to the study area, including American coot, rails, gallinules, common snipe, and American woodcock. Non-game bird species also utilize the study area marshes, including least bittern, pied-billed grebe, black-necked stilt, American avocet, killdeer, black-bellied plover, willet, and various species of sandpipers, gulls, and terns. The study area supports many resident and transient hawks and owls including red-shouldered hawk, barn owl, common screech owl, great horned owl, and barred owl. Winter residents include red-tailed hawk, northern harrier, and American kestrel, while the Mississippi kite, swallow-tailed kite and broad-winged hawk are common summer residents. In addition, the project area supports many species of resident and migratory passerine birds. Some neo-tropical migrants that are currently experiencing a population decline (e.g., white-eyed vireo, northern parula) are dependent on large forested acreage to successfully reproduce. Also, present are cuckoos, swifts, hummingbirds, nighthawks, woodpeckers, and the belted kingfisher.

Invasive Species

Within the LCA-ARDC study area invasive mammal species present include nutria and feral hogs. Invasive plant species present within that area include: water hyacinth, alligator weed, hydrilla, common salvinia, giant salvinia, variable-leaf milfoil, Chinese tallow, and Chinese privet. Those species displace native aquatics and degrade water and/or habitat quality. In addition, Chinese tallow is tolerant to flooding and salt stress and can establish self-replacing

monocultures that provide less foraging value to migrating birds and interrupt the natural succession of woody species (Louisiana Coastal Protection and Restoration 2008).

Threatened and Endangered Species

West Indian Manatee

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have

negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. The proposed project, however, does not occur within nor would it impact designated Gulf sturgeon critical habitat.

The Corps is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the Corps determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the ESA should be submitted to the Service. That request should also include the Corps' rationale supporting their determination.

Species of Special Interest

Bald Eagle

The project-area forested wetlands provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. There is one active bald eagle nest that is known to exist within the proposed project area, however, other nests may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries.

Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern Parishes. Areas with high numbers of nests include the north shore of Lake Pontchartrain and the Lake Salvador area. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the Bald and Golden Eagle Protection Act (BGEPA). The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may

constitute “disturbance,” which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at:
http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf.
Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at:
http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. A copy of that determination should be provided to this office.

Colonial Nesting Birds

The proposed project would be located in an area where colonial nesting waterbirds may be present. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries. That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonial nesting birds, the following restriction on activity should be observed:

> For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

Refuges and Wildlife Management Areas

There are no U.S. Fish and Wildlife Service National Wildlife Refuges located within the LCA-ARDC study area. A portion of the state-operated Maurepas Swamp Wildlife Management Area is located within that study area. Please contact the Louisiana Department of Wildlife and Fisheries in Baton Rouge, Louisiana, (225/765-2360) for their comments regarding potential project impacts to this area.

EVALUATION METHODOLOGY

Evaluation of project-related impacts on fish and wildlife resources was aided by use of the

Wetland Value Assessment (WVA) methodology developed for the evaluation of proposed CWPPRA projects (Louisiana Coastal Wetlands Conservation and Restoration Task Force [LCWCRTF] 2006). The WVA methodology is similar to the Service's Habitat Evaluation Procedures (HEP), in that habitat quality and quantity are measured for baseline conditions and predicted for future without-project (FWOP) and future with-project (FWP) conditions. Separate habitat assessment models were used, including the Swamp and Bottomland Hardwood Community Models. Instead of the species-based approach of HEP, each model utilizes an assemblage of variables considered important to the suitability of a given habitat type for supporting a diversity of fish and wildlife species. As with HEP, these models allow a numeric comparison of each future condition and provide a combined quantitative and qualitative estimate of project-related impacts to fish and wildlife resources.

The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each habitat type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Indices) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

The WVA methodology was initially developed in 1991 by the CWPPRA Environmental Work Group (LCWCRTF 2006). Initially, emergent marsh habitat models were developed for fresh, intermediate, brackish and saline marsh types. Subsequently, models were also developed for swamps, barrier islands, barrier headlands, and coastal forested ridges. The habitat variable-habitat suitability relationships within the WVA models have not been verified by field experiments or validated through a rigorous scientific process. However, the variables were originally derived from HEP suitability indices taken from species models for species found in that habitat type. It should also be noted that some aspects of the WVA have been defined by policy and/or functional considerations of CWPPRA. However, habitat variable-habitat suitability relationships are, in most cases, supported by scientific literature and research findings. In other cases, best professional judgment by a team of fisheries biologists, wildlife biologists, ecologists, and university scientists may have been used to determine certain habitat variable-habitat suitability relationships. In addition, the WVA models have undergone a refinement process and habitat variable-habitat suitability relationships, HSIs, and other model aspects are periodically modified as more information becomes available regarding coastal fish and wildlife habitat suitability, coastal processes, and the efficacy of restoration projects being evaluated.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The CWPPRA swamp WVA model used consists of four variables: 1) stand structure; 2) stand maturity; 3) water regime; and 4) mean

high salinity during the growing season. The bottomland hardwood WVA model consists of seven variables: 1) tree species association; 2) stand maturity; 3) understory/midstory; 4) hydrology; 5) size of contiguous forested area; 6) suitability and traversability of surrounding land uses; and 7) disturbance.

Using the WVA methodology, impact assessments were conducted by the Habitat Evaluation Team (HET), which included representatives from the Service, the Corps, Office of Coastal Protection and Restoration, GEC, Southeast Louisiana University, and Taylor Engineering. To assess impacts the HET used habitat information collected during June and July 2009 field inspections, surveys, expert opinions, knowledge of the area, experience with similar projects, Digital Ortho-quarter Quadrangle aerial photographs (DOQQ), and hydraulics and hydrology modeling information.

Those elements were used in conjunction with the above-discussed mathematical models to compute an HSI value for each target year (TY). Target years identified within the LCA-ARDC WVA model runs include: TY0, TY1, TY10, TY25, and TY50.

The product of an HSI and the acreage of available habitat for a given target year is known as the Habitat Unit (HU). The HU is the basic unit for measuring project effects on fish and wildlife habitat. Future HUs change according to changes in habitat quality and/or quantity. Results are annualized over the project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type.

The seven alternatives within the LCA-ARDC Final Array were evaluated: Alternative 33 (NE-1/NE-2), Alternative 34 (SE-1/SE-2), Alternative 35 (SE-1), Alternative 36 (NE-1/NE-2, SE-1/SE-2), Alternative 37 (SE-1/SE-2, SE-1), Alternative 38 (NE-1/NE-2, SE-1), and Alternative 39 (NE-1/NE-2, SE-1/SE-2 – All Subunits Combined). Prior to running the WVA analysis, the benefit areas associated with each alternative were designated as either primary impact areas or secondary impact areas. For purposes of the WVA, the Service assumed that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments, while the secondary impact areas would receive lesser benefits.

Subsequent to the mapping of primary and secondary impact areas for each alternative, WVAs were run for each habitat type (i.e., degraded swamp/fresh marsh, 10 years to convert to marsh, 20-30 years to convert to marsh, and 30-50 years to convert to marsh) present within those areas. Once benefits were calculated, adverse temporary and permanent impacts to swamp and bottomland hardwood habitats associated with construction of the bank openings, conveyance channels, and dredged material placement were calculated. The change in AAHUs for each FWP scenario, compared to FWOP project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type.

The WVA initial analysis was completed on the primary and secondary impact areas for all alternatives under the low sea level rise (SLR) scenario. As requested by the Corps, additional WVAs were later run to quantify impacts under the intermediate and high SLR scenarios for the Tentatively Selected Plan and the National Ecosystem Restoration Plan. A combined total of

168 WVA evaluations were completed.

The Project Information Sheet (including assumptions used by the HET) and the WVA summary sheet for the LCA-ARDC project are presented in Appendix A and B, respectively. The complete WVA analysis can be obtained from the Service's Lafayette, Louisiana Ecological Services Office upon request.

FUTURE WITHOUT-PROJECT FISH AND WILDLIFE RESOURCES

Under future without-project conditions, the current problems associated with altered hydrology are expected to continue. The swamp habitat surrounding the ARDC will likely continue to degrade, resulting in the eventual conversion from a freshwater swamp to open water. The lack of hydrologic connectivity would result in the continued impoundment of the project-area swamp, with an associated reduction in canopy cover, degradation of water quality, and transition of swamp habitat to marsh, with the eventual conversion to open-water habitat. Storm surges from tropical cyclone events would increase salinity levels and the frequency of saltwater inundation is expected to increase with relative sea level rise (RSLR).

The lack of freshwater, sediments, and nutrients would continue to reduce tree vigor and growth, increase tree mortality, increase the presence of invasive species, and reduce ecological functions. In addition, the assumed RSLR, would exacerbate swamp degradation in the future.

The anticipated conversion of swamp habitats to marsh and open water would result in the loss of wetland values and functions. While the Service recognizes the ecological importance of freshwater marshes, most of the marshes present within the LCA-ARDC study area are present as a transitional habitat, as swamps convert to open water, and are the result of habitat deterioration and conversion, rather than healthy swamp/marsh interfaces. Keddy et al. (2007) reports that the vast majority of the Maurepas Swamp is typical of swamps identified as either nutrient poor and stagnant or near-continuously flooded. Flood durations in the Maurepas Swamp have doubled, on average, over the past half-century (Thomson et al. 2002). The flooding and impoundment within the study area prevents seed germination and recruitment and, as a result, swamps are converting to marsh and open water.

Keddy et al. (2007) identify priority actions for habitat restoration within the Maurepas Swamp. One such recommendation addresses the re-establishment of sheet flow via removal or gapping of dredged material berms and road and railroad beds. They explain that sheet flow (or shallow water flow over the surface of the soil) was, most likely, the principle way in which water and nutrients moved through this system. Now, however, the presence of man-made hydrologic barriers impedes sheet flow. Canals decrease overbank flooding and accelerate the flow of water, sediment, and nutrients out of the area, while dredged material berms and other such man-made features block sheet flow. Implementation of the proposed project would restore an historic ecosystem and increase the fish and wildlife habitat values of the project area.

DESCRIPTION OF NATIONAL ECOSYSTEM RESTORATION PLAN

Alternative 39 (Figure 2) has been identified as the NER and the best plan for ecosystem

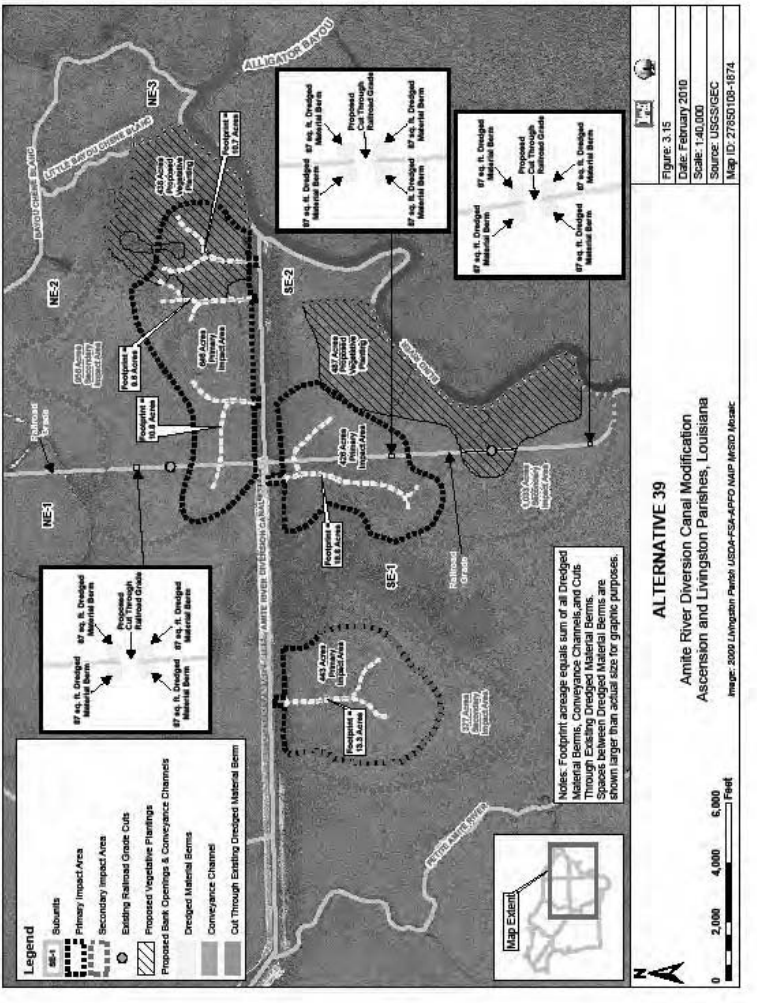


Figure 2. Alternative 39

restoration in the study area. That plan includes three areas for restoration in the final array, including two that have a critical need, and have begun converting from swamp to marsh, and a third less critical area that is expected to begin conversion in the next 20-30 years. Due to funding limitations and the risk of losing authorization, however, Alternative 39 has not been designated as the tentatively selected plan (TSP).

Features of Alternative 39 include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
- One opening and one conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (9.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps would be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately two miles south of the ARDC.
- Vegetative plantings of bottomland hardwood/swamp tree species on 9.9 acres of dredged material berms.
- Vegetative plantings of swamp tree species within 925 acres of the swamp floor.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, were designed to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile.

The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

EVALUATION OF NATIONAL ECOSYSTEM RESTORATION PLAN

Alternative 39 includes all of the most critical areas within the Maurepas Swamp basin, establishes the greatest amount of hydrologic connectivity of all of the alternatives, is cost-effective while providing the most benefits, and is a best-buy plan. Accordingly, the Service fully supports Alternative 39 as the NER plan and believes it best represents the long term restoration need for the area.

The WVA evaluations conducted on all alternatives within the final array show that the highest

net benefits to fish and wildlife habitats occur with implementation of Alternative 39. Specifically, the WVA analysis indicates that the NER for the LAC-ARDC project would result in net gains of 1,602, 1,516, and 1,452 AAHUs under the low, intermediate, and high SLR scenarios, respectively.

Swamp habitat for fish and wildlife species would be restored, mimicking as closely as possible, conditions which occurred historically in the area. Implementation of Alternative 39 would restore the hydrologic connectivity between NE-1, NE-2, SE-1, and SE-2 within the ARDC. That alternative would improve the hydrologic connectivity between the ARDC and approximately 3,881 acres in both the primary and secondary impact areas, restore approximately 290 acres of swamp, and create approximately 9.9 acres of upland habitat from dredged material placement. Restored hydrologic connections would: 1) increase the nutrient and sediment input to approximately 1,515 acres within the primary impact area, 2) increase acreage of high-quality swamp habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements, and 3) increase vegetative growth and productivity. In addition, when compared to the future without project scenario, implementation of this alternative would significantly reduce the likelihood of 3,881 acres of existing swamp habitat converting to marsh and eventual open water habitat over the life of the project.

DESCRIPTION OF TENTATIVELY SELECTED PLAN

Because the NER plan (Alternative 39) cannot be constructed within the currently authorized cost cap, Alternative 33 (Figure 3) was chosen as the TSP.

Alternative 33 includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, were designed to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile.

The material dredged from the existing berms would be placed along the swamp-side of the

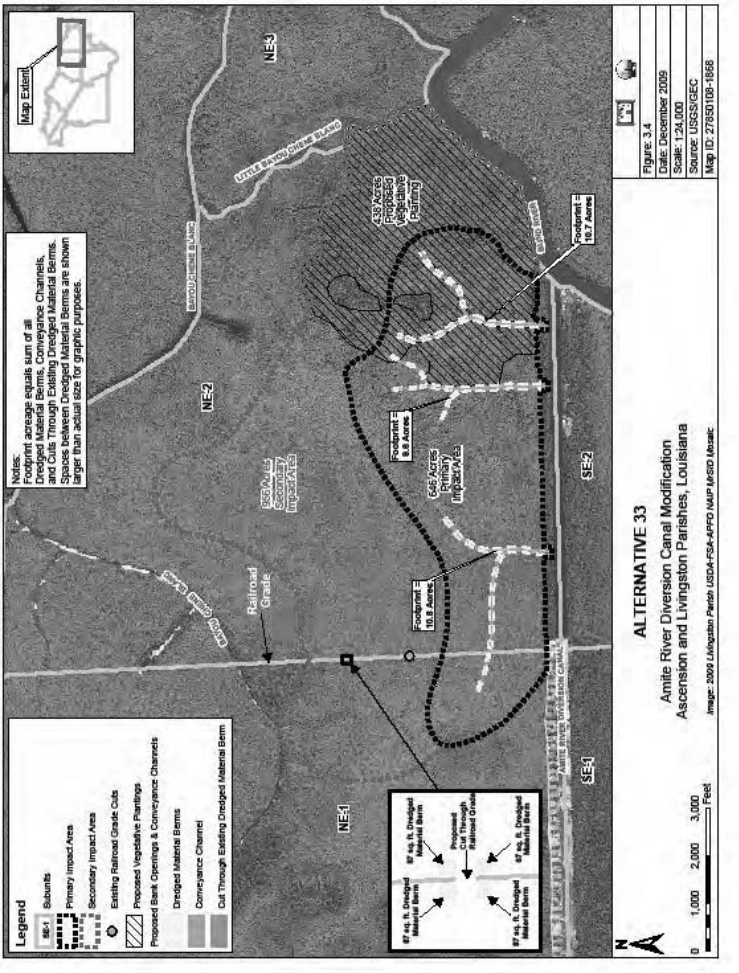


Figure 3. Alternative 33

excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

EVALUATION OF TENTATIVELY SELECTED PLAN

Alternative 33 addresses the most-highly degraded portion of the study area (NE-2), is considered cost effective, and can be implemented within the current cost cap. Implementation of that alternative, however, would not address the restoration needs within SE-1 and SE-2. Implementation of Alternative 33 would, therefore, result in similar benefits as expected under Alternative 39, but to a lesser degree. Specifically, Alternative 33 would improve the hydrologic connectivity between the ARDC and approximately 1,602 acres in both the primary and secondary impact areas, restore approximately 144 acres of swamp, and create approximately 5.0 acres of upland habitat from dredged material placement. The WVA analysis indicates that the TSP for the LAC-ARDC project would result in net gains of 679, 640, and 610 AAHUs under the low, intermediate, and high SLR scenarios, respectively.

FISH AND WILDLIFE CONSERVATION AND MITIGATION MEASURES

Swamp habitats are considered by the Service to be aquatic resources of national importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and interjurisdictional fisheries). Because of the Services' close coordination with the USACE on this project, and because the project is expected to have an overall benefit to the LCA-ARDC study area, the Service has no conservation measures to offer at this time.

SERVICE POSITION AND RECOMMENDATIONS

The TSP will benefit the fish and wildlife resources of the LCA-ARDC area by providing freshwater, nutrients, and sediments to the study area thus facilitating sediment deposition, increase organic production, increase biological productivity, and reduce conversion of swamp habitat to open water. Approximately 679 AAHUs and 1,602 net acres of swamp habitats would benefit by the proposed project at the end of the project life. The Service supports implementation of Alternative 33 provided the following fish and wildlife recommendations are implemented concurrently with project implementation:

1. If authorized funding limits for this project are increased the Service recommends that Alterative 39 be reconsidered as the potential future TSP.

2. If a proposed project feature is changed significantly or is not implemented within one year of the Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with our office to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their critical habitat.

3. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through

careful design of project features and timing of construction. A qualified biologist should inspect the proposed work site for the presence of undocumented wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies, and October through mid-May for bald eagles).

4. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

5. Because bald eagles are known to nest within the proposed study area, we recommend that an evaluation be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary and those results should be forwarded to this office.

6. Land clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

7. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on the all work addressed in those reports.

8. A report documenting the status of implementation, maintenance and adaptive management measures should be prepared every three years by the managing agency and provided to the Corps, the Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Office of Coastal Protection and Restoration, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

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APPENDIX A

PROJECT INFORMATION SHEET WITH ASSUMPTIONS FOR LCA-ARDC

Wetland Value Assessment Project Information Sheet
December 2009

Project Name: Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project

Project Type(s): Swamp restoration, hydrologic restoration, and vegetative planting

Sponsoring Agency: U.S. Army Corps of Engineers (USACE) and Louisiana Department of Natural Resources

Preparer of Wetland Value Assessment (WVA) information sheet: Karen Soileau
Information found in this project information sheet was obtained primarily from the Draft Feasibility Report appendix (CPE 2005 and 2007).

Project Area: The project area is situated along the Amite River Diversion Canal (ARDC) in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The project area is focused around the impaired bald cypress-tupelo swamp stands adjacent to the ARDC, extending northward and southward of the canal in the western portion of the Maurepas Swamp, located within the Pontchartrain Basin.

Project area boundaries were developed and delineated based on hydrologic features of the area suspected of being influenced by the LCA ARDC Modification project. For planning purposes, the project area was further divided into nine sub-areas. Those sub-areas are defined by topographic high points (e.g., dredged material berms, relict railroad grade, road embankments) or natural and artificial channels (e.g., rivers, canals) that would serve to impede or intercept hydrologic flows.

Problem: The project area includes the ARDC, a 10.6-mile-long flood control channel between the Amite and Blind Rivers. Dredged material excavated during channel construction was deposited in dredged material berms on either side of the canal. The construction of the ARDC and its associated dredged material berms, and the resulting impoundment, channelization, surge-related saltwater intrusion, and the loss of freshwater, sediments, and nutrients from the Amite River have all caused significant adverse impacts to the area, resulting in poor swamp health and ecosystem degradation in the western Maurepas Swamp.

Goal: The goal of the LCA ARDC Modification project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, so as to contribute toward achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

Objectives:

- Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.
- Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.
- Facilitate natural hydrologic cycle within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.
- Improve fish and wildlife habitat within the study area over the 50-year period of analysis.

Project Features:

1. Freshwater Reintroduction – Restoring processes that input freshwater, nutrients, and sediments are essential for establishing sustainable coastal swamp systems. The implementation of freshwater reintroduction measures that establish hydrologic connectivity between study area waterbodies and the adjacent swamp habitat could nourish existing swamp habitat to increase productivity and restore areas that have converted to freshwater marsh or open water, reintroduce sediments and nutrients throughout the ecosystem, and allow aquatic organisms access to previously unavailable habitats. The benefits that such reintroductions produce increase over time and continue as long as the reintroduction is operated and maintained. Additionally, freshwater reintroductions can be adaptively managed to respond to environmental changes and optimize benefits.

2. Habitat Restoration – The majority of the Maurepas Swamp is stressed as a result of hydrologic alteration and seems to be on a trajectory of slow degradation leading to a gradual conversion to marsh and open water (Hoeppner *et al.*, 2007). Without restoration, the factors and processes that are contributing to stress and deterioration of the swamps in the vicinity of the ARDC would continue and would result in loss of the swamp, with succession to open water. The wetland loss rates for the Coast 2050 Amite/Blind Rivers mapping unit (which contains the study area) for 1974-90 were estimated by the Corps to be 0.83 percent per year for swamp habitat, and 0.02 percent per year for fresh marsh. Based on these rates, approximately 50 percent of swamp and 1.2 percent of fresh marsh would be lost within 60 years (Coastal Wetlands Planning, Protection, and Restoration Act [CWPPRA] Task Force, 2002). Additionally, the Corps determined that, based on the low tree density, degraded condition, and expectation for mortality, the majority of swamp habitat within the study area would degrade to less than 33 percent canopy cover within 20 years (USACE, 2004). Under the continued influence of these conditions, tree mortality would continue to increase and tree density would continue to decline, until most swamp habitat in the vicinity of the ARDC converts to fresh marsh. Monitoring studies conducted for the CWPPRA Priority Project List 12 (PPL 12) proposal indicated that conversion of bald cypress-tupelo swamp to fresh marsh is already occurring in the study area,

particularly north of the ARDC in subunit NE-2 (CWPPRA Task Force, 2002). Additionally, the monitoring results indicate that many areas of fresh marsh in the greater southern Maurepas Swamp have converted to fragile spikerush flotant, which is particularly susceptible to nutrient starvation and fragmentation. Consequently, it is expected that the vast majority of swamp habitat adjacent to the ARDC would convert to open water rather than stable marsh habitat without implementation of the proposed project.

LOW SEA LEVEL RISE SCENARIO ASSUMPTIONS

Primary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (U.S. Department of Agriculture [USDA] 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should continue to improve habitat conditions within the area. Accordingly, we anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His diameter at breast height (dbh) estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our Wetland Value Assessment (WVA) data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated utilizing data collected by Southeast Louisiana University and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future

without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees in the canopy was increased over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within this portion of the project area are permanently flooded and have no flow/exchange.

Future Without Project

Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario and we anticipate the project area to remain permanently flooded with no flow/exchange.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Because the subject area is impounded with no flow/exchange we expect the

salinity to increase over time. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980)

and would, therefore, be considered a component of the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50

year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the high benefit areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project

area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to

continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a

Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling

germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions

are higher in the 20 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 parts per thousand [ppt] from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a

Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling

germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future Without Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .15 inches per year tupelo et al = .10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from time year 0 to 25 and decrease significantly between time year 25 and 50 due to the projected loss of canopy cover.

Future With Project

Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA and information provided by Mr. Bernard Wood. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under

the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

Secondary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (USDA 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative

planting should continue to improve habitat conditions within the area. Accordingly, we anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our WVA data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual

mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and is assumed to result in similar conditions as the 155 acre fresh marsh high benefit area since vegetated plantings are proposed.

Variable 3: Water Regime

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

At present the Maurepas Swamp within this portion of the project area are semi-permanently flooded and have low flow/exchange.

Future <u>Without</u> Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future <u>With</u> Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion)

the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because

construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient

enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore,

anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that

mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between

6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 20 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decrease from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would

receive benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to

less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future <u>With</u> Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future <u>With</u> Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future <u>With</u> Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future <u>Without</u> Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .15 inches per year tupelo et al = .10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from time year 0 to 25 and decrease significantly between time year 25 and 50 due to the projected loss of canopy cover.

Future <u>With</u> Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive benefits from freshwater flows, nutrients,

and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project

within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a temporary flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL

12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

APPENDIX B

WVA SUMMARY SHEET FOR LCA-ARDC

Low SLR

Alternative 34:

• Fresh Marsh Primary Impact Area	=	70.88 AAHUs	3544.07 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.22 AAHUs	1761.10 CHUs
• 10 Years to Marsh Secondary Impact Area	=	73.46 AAHUs	3673.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	189.48 AAHUs	9474.01 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	252.40 AAHUs	12621.00 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	27.29 AAHUs	1364.40 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	50.05 AAHUs	2501.13 CHUs
• 50-50 Years to Marsh Secondary Impact Area	=	-0.03 AAHUs	-27.60 CHUs
• Spoil Bank Permanent Impacts	=	-0.22 AAHUs	-11.08 CHUs
• Spoil Bank Temporary Impacts	=	-0.23 AAHUs	-11.54 CHUs
• Fresh Marsh Permanent Impacts	=	-1.23 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.71 AAHUs	-35.53 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.79 AAHUs	-239.12 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.80 AAHUs	-89.89 CHUs
TOTAL	=	879.46 AAHUs	33973.16 CHUs

Alternative 35:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	81.29 AAHUs	4063.86 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	59.83 AAHUs	2991.75 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	67.25 AAHUs	3362.33 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	9.08 AAHUs	468.23 CHUs
• Spoil Bank Permanent Impacts	=	-0.63 AAHUs	-31.04 CHUs
• Spoil Bank Temporary Impacts	=	-0.22 AAHUs	-10.91 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-1.57 AAHUs	-83.90 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-5.76 AAHUs	-287.98 CHUs
TOTAL	=	588.58 AAHUs	29428.75 CHUs

Alternative 36:

• 20-30 Years to Marsh Primary Impact Area	=	143.90 AAHUs	7199.09 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	114.96 AAHUs	5748.00 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	56.05 AAHUs	2802.27 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	26.00 AAHUs	1299.91 CHUs
• Spoil Bank Permanent Impacts	=	-0.41 AAHUs	-20.70 CHUs
• Spoil Bank Temporary Impacts	=	-0.23 AAHUs	-11.39 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-2.54 AAHUs	-127.14 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-2.15 AAHUs	-107.47 CHUs
TOTAL	=	333.60 AAHUs	16679.91 CHUs

Alternative 37:

• Fresh Marsh Primary Impact Area	=	70.88 AAHUs	3544.07 CHUs
• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	19.19 AAHUs	3709.30 CHUs
• 10 Years to Marsh Secondary Impact Area	=	297.18 AAHUs	14859.05 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	370.76 AAHUs	13588.17 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	312.20 AAHUs	15612.74 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	94.54 AAHUs	4727.23 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	49.41 AAHUs	2470.56 CHUs
• Spoil Bank Permanent Impacts	=	-1.17 AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	=	-1.32 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.99 AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.37 AAHUs	-218.70 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-7.63 AAHUs	-377.95 CHUs
TOTAL	=	1268.04 AAHUs	63401.93 CHUs

Alternative 37:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	36.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	225.20 AAHUs	11259.95 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	170.81 AAHUs	8540.63 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	105.30 AAHUs	5264.80 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	35.38 AAHUs	1769.02 CHUs
• Spoil Bank Permanent Impacts	=	-1.05 AAHUs	-51.75 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.21 AAHUs	-210.74 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-7.61 AAHUs	-380.33 CHUs
TOTAL	=	922.17 AAHUs	46108.65 CHUs

Alternative 38:

• Fresh Marsh Primary Impact Area	=	70.88 AAHUs	3544.07 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.22 AAHUs	1761.10 CHUs
• 10 Years to Marsh Secondary Impact Area	=	73.46 AAHUs	3673.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	332.41 AAHUs	16672.46 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	383.40 AAHUs	19169.89 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	85.33 AAHUs	4266.67 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	66.00 AAHUs	3300.96 CHUs
• Spoil Bank Permanent Impacts	=	-0.97 AAHUs	-48.20 CHUs
• Spoil Bank Temporary Impacts	=	-0.46 AAHUs	-22.76 CHUs
• Fresh Marsh Permanent Impacts	=	-1.23 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.71 AAHUs	-35.53 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-7.05 AAHUs	-352.28 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-3.98 AAHUs	-197.76 CHUs
TOTAL	=	1013.06 AAHUs	50653.09 CHUs

Alternative 39:

• Fresh Marsh Primary Impact Area	=	70.88 AAHUs	3544.07 CHUs
• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	74.19 AAHUs	3709.30 CHUs
• 10 Years to Marsh Secondary Impact Area	=	367.18 AAHUs	18368.20 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	414.89 AAHUs	20734.28 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	422.23 AAHUs	21101.85 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	152.59 AAHUs	7629.39 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	76.40 AAHUs	3770.16 CHUs
• Spoil Bank Permanent Impacts	=	-1.59 AAHUs	-79.35 CHUs
• Spoil Bank Temporary Impacts	=	-0.77 AAHUs	-38.07 CHUs
• Fresh Marsh Permanent Impacts	=	-1.32 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.99 AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-8.82 AAHUs	-440.86 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-9.11 AAHUs	-455.42 CHUs
TOTAL	=	1601.64 AAHUs	80081.64 CHUs

Intermediate SLR

Alternative 34:

• Fresh Marsh Primary Impact Area	=	66.15 AAHUs	3307.67 CHUs
• 10 Years to Marsh Primary Impact Area	=	34.54 AAHUs	1726.90 CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.45 AAHUs	3372.29 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	183.18 AAHUs	9174.09 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	232.19 AAHUs	11604.55 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.26 AAHUs	1305.14 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.31 AAHUs	1866.55 CHUs
• Spoil Bank Permanent Impacts	=	-0.05 AAHUs	-27.60 CHUs
• Spoil Bank Temporary Impacts	=	-0.23 AAHUs	-11.08 CHUs
• Fresh Marsh Permanent Impacts	=	-1.32 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.68 AAHUs	-32.80 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.37 AAHUs	-218.27 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.76 AAHUs	-88.17 CHUs
TOTAL	=	640.32 AAHUs	32015.90 CHUs

Alternative 35:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	81.29 AAHUs	4063.86 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	59.83 AAHUs	2991.75 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	67.25 AAHUs	3362.33 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	9.08 AAHUs	468.23 CHUs
• Spoil Bank Permanent Impacts	=	-0.63 AAHUs	-31.04 CHUs
• Spoil Bank Temporary Impacts	=	-0.22 AAHUs	-10.91 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-1.57 AAHUs	-83.90 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-5.76 AAHUs	-287.98 CHUs
TOTAL	=	588.58 AAHUs	29428.75 CHUs

Alternative 36:

• Fresh Marsh Primary Impact Area	=	66.15 AAHUs	3307.67 CHUs
• Fresh Marsh Secondary Impact Area	=	42.02 AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	72.75 AAHUs	3637.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	337.11 AAHUs	16853.69 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	392.18 AAHUs	13168.95 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	281.83 AAHUs	14091.23 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	80.19 AAHUs	4834.98 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	46.83 AAHUs	2340.19 CHUs
• Spoil Bank Permanent Impacts	=	-1.17 AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	=	-1.32 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.99 AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-8.82 AAHUs	-440.86 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-7.41 AAHUs	-370.31 CHUs
TOTAL	=	1190.54 AAHUs	84638.00 CHUs

Alternative 37:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	36.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	225.20 AAHUs	11259.95 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	170.81 AAHUs	8540.63 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	105.30 AAHUs	5264.80 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	35.38 AAHUs	1769.02 CHUs
• Spoil Bank Permanent Impacts	=	-1.05 AAHUs	-51.75 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.21 AAHUs	-210.74 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-7.61 AAHUs	-380.33 CHUs
TOTAL	=	922.17 AAHUs	46108.65 CHUs

Alternative 38:

• Fresh Marsh Primary Impact Area	=	66.15 AAHUs	3307.67 CHUs
• Fresh Marsh Secondary Impact Area	=	42.02 AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	72.75 AAHUs	3637.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	337.11 AAHUs	16853.69 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	406.80 AAHUs	20344.99 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	390.92 AAHUs	19545.93 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	148.84 AAHUs	7442.12 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	71.43 AAHUs	3571.45 CHUs
• Spoil Bank Permanent Impacts	=	-1.59 AAHUs	-79.35 CHUs
• Spoil Bank Temporary Impacts	=	-0.77 AAHUs	-38.07 CHUs
• Fresh Marsh Permanent Impacts	=	-1.32 AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.99 AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-8.82 AAHUs	-440.86 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-9.53 AAHUs	-476.11 CHUs
TOTAL	=	1515.53 AAHUs	75776.57 CHUs

High SLR

Alternative 34:

• Fresh Marsh Primary Impact Area	=	58.99 AAHUs	2949.66 CHUs
• 10 Years to Marsh Primary Impact Area	=	31.57 AAHUs	1578.33 CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.09 AAHUs	3354.57 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	175.58 AAHUs	8508.05 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	226.81 AAHUs	11335.55 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.42 AAHUs	1320.83 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.46 AAHUs	1873.27 CHUs
• Spoil Bank Permanent Impacts	=	-0.05 AAHUs	-27.60 CHUs
• Spoil Bank Temporary Impacts	=	-0.23 AAHUs	-11.08 CHUs
• Fresh Marsh Permanent Impacts	=	-1.30 AAHUs	-64.80 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.62 AAHUs	-31.26 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.16 AAHUs	-207.75 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.83 AAHUs	-91.71 CHUs
TOTAL	=	610.20 AAHUs	30509.94 CHUs

Alternative 35:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	81.29 AAHUs	4063.86 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	59.83 AAHUs	2991.75 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	67.25 AAHUs	3362.33 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	9.08 AAHUs	468.23 CHUs
• Spoil Bank Permanent Impacts	=	-0.63 AAHUs	-31.04 CHUs
• Spoil Bank Temporary Impacts	=	-0.22 AAHUs	-10.91 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-1.57 AAHUs	-83.90 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-5.76 AAHUs	-287.98 CHUs
TOTAL	=	588.58 AAHUs	29428.75 CHUs

Alternative 36:

• Fresh Marsh Primary Impact Area	=	58.99 AAHUs	2949.66 CHUs
• Fresh Marsh Secondary Impact Area	=	40.91 AAHUs	2045.56 CHUs
• 10 Years to Marsh Primary Impact Area	=	69.49 AAHUs	3474.39 CHUs
• 10 Years to Marsh Secondary Impact Area	=	333.10 AAHUs	16704.86 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	343.73 AAHUs	12198.05 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	283.32 AAHUs	14016.16 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	81.52 AAHUs	4076.08 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	46.25 AAHUs	2312.45 CHUs
• Spoil Bank Permanent Impacts	=	-1.17 AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	=	-1.30 AAHUs	-64.80 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.67 AAHUs	-33.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-3.63 AAHUs	-181.62 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-6.66 AAHUs	-332.18 CHUs
TOTAL	=	1146.92 AAHUs	57346.02 CHUs

Alternative 37:

• Fresh Marsh Secondary Impact Area	=	46.79 AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	36.96 AAHUs	1848.18 CHUs
• 10 Years to Marsh Secondary Impact Area	=	292.72 AAHUs	14666.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	225.20 AAHUs	11259.95 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	170.81 AAHUs	8540.63 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	105.30 AAHUs	5264.80 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	35.38 AAHUs	1769.02 CHUs
• Spoil Bank Permanent Impacts	=	-1.05 AAHUs	-51.75 CHUs
• Spoil Bank Temporary Impacts	=	-0.54 AAHUs	-27.19 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.28 AAHUs	-14.31 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.21 AAHUs	-210.74 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-7.61 AAHUs	-380.33 CHUs
TOTAL	=	922.17 AAHUs	46108.65 CHUs

Alternative 38:

• Fresh Marsh Primary Impact Area	=	58.99 AAHUs	2949.66 CHUs
• Fresh Marsh Secondary Impact Area	=	40.91 AAHUs	2045.56 CHUs
• 10 Years to Marsh Primary Impact Area	=	69.49 AAHUs	3474.39 CHUs
• 10 Years to Marsh Secondary Impact Area	=	333.10 AAHUs	16704.86 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	373.21 AAHUs	18662.28 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	378.90 AAHUs	18947.52 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	141.71 AAHUs	7085.57 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	70.58 AAHUs	3528.16 CHUs
• Spoil Bank Permanent Impacts	=	-1.59 AAHUs	-79.35 CHUs
• Spoil Bank Temporary Impacts	=	-0.77 AAHUs	-38.07 CHUs
• Fresh Marsh Permanent Impacts	=	-1.30 AAHUs	-64.80 CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.67 AAHUs	-33.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-7.85 AAHUs	-393.96 CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-8.92 AAHUs	-441.31 CHUs
TOTAL	=	1451.77 AAHUs	72586.63 CHUs

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

September 2, 2010

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Enclosed is the Final Fish and Wildlife Coordination Act Report on the Louisiana Coastal Area – Amite River Diversion Canal Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study. Copies of the draft report were provided to the National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries for their review and their comments were incorporated into the final report. This report is transmitted pursuant the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Ms. Karen Soileau (337/291-3132) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Enclosure

cc: EPA, Dallas, TX
National Marine Fisheries Service, Baton Rouge, LA
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
Office of Coastal Protection and Restoration, Baton Rouge, LA
GEC, Baton Rouge, LA

TAKE PRIDE IN AMERICA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

September 2, 2010

Robert J. Barham
Secretary
Louisiana Department of Wildlife and Fisheries
Post Office Box 98000
Baton Rouge, Louisiana 70898-9000

Dear Mr. Barham:

Enclosed, for your records, is the Final Fish and Wildlife Coordination Act Report on the Louisiana Coastal Area – Amite River Diversion Canal Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study. This report was prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Karen Soileau (337/291-3132) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Enclosure

TAKE PRIDE IN AMERICA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

September 2, 2010

Mr. Richard Hartman
Branch Chief
Habitat Conservation Division
National Marine Fisheries Service
c/o Louisiana State University
Baton Rouge, Louisiana 70803-7535

Dear Mr. Hartman:

Enclosed, for your records, is the Final Fish and Wildlife Coordination Act Report on the Louisiana Coastal Area – Amite River Diversion Canal Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study. Your agencies comments were incorporated into this final report. This report was prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Karen Soileau (337/291-3132) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Enclosure

TAKE PRIDE IN AMERICA

Fish and Wildlife Coordination Act Report

Louisiana Coastal Area (LCA)
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Submitted To
New Orleans District
U.S. Army Corps of Engineers
and
Office of Coastal Protection and Restoration

Prepared by
Karen Soileau
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services
Lafayette, Louisiana

September 2010

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INTRODUCTION

The Louisiana Coastal Area – Amite River Diversion Canal (LCA-ARDC) Modification Integrated Feasibility Report and Environmental Impact Statement (EIS) was prepared by the U.S. Army Corps of Engineers (USACE), New Orleans District, in partnership with the Louisiana Office of Coastal Protection and Restoration, under the authority of Title VII of the Water Resources Development Act (WRDA) of 2007. This authorization was recommended by the Chief of Engineer's Report, dated January 31, 2005. That report recommended projects and features in the interest of hurricane protection, prevention of salt water intrusion, preservation of fish and wildlife, prevention of erosion, and related water resources purposes. One recommended project was the modification of the ARDC.

The LCA-ARDC project is designed to establish hydrologic connectivity between the ARDC and the western Maurepas Swamp. That connectivity would allow the swamp to drain during seasonal low-flow conditions in the Amite River, and thereby, promote the germination and survival of bald cypress (and other tree species) seedlings. In addition, nutrients and sediments would be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events. Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat degradation and swamp loss via conversion to open water.

This draft report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed restoration measures. Copies of the draft report were provided to the National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries for their review and their comments were incorporated into the final report. This report is transmitted pursuant the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

DESCRIPTION OF THE STUDY AREA

In the 1950s, the USACE, in an effort to relieve flooding along the upper Amite River, constructed the ARDC in order to facilitate the flow of water from the Amite River to Lake Maurepas. The 10 mile long canal is 350 feet wide and was dug to a depth of -25 feet. The LCA-ARDC study area (Figure 1) is located in LCA Subprovince 1 (USACE 2004) and is situated along the ARDC in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal.

Historically, hydrologic conditions within the LCA-ARDC study area were dominated in the north and west by the Amite River, in the south by overbank flow from the Mississippi River,

and in the east by tidal influence from Lake Maurepas. Periodic flooding of the Amite River and/or Mississippi River resulted in the inundation of the study area. Flooding occurred annually, with peak water elevations in the spring or early summer. As floodwaters receded, surface waters in the study area were conveyed eastward via sheet flow to Bayou Chene Blanc or Blind River, then to Lake Maurepas.

The construction of flood control projects within the LCA-ARDC study area, primarily the ARDC component of the Amite River and Tributaries (AR&T) project, together with other land use practices, such as land development and logging, have significantly altered the hydrologic regime of the study area. River channelization and levee construction reduced overbank flooding in the study area, which in turn reduced the influx of floodwaters bearing high volumes of nutrients and sediment that are essential for biomass production and soil accretion. In addition, the placement of dredged material as berms along either side of the ARDC disrupted sheet flow within the LCA-ARDC study area and formed topographic high points (ridges) that prevented the drainage of bald cypress-tupelo swamps into the ARDC during low surface flow intervals (USACE 2004). This activity, in conjunction with other activities, such as construction of the railroad grade that traverses the eastern study area from north to south, permanently impounded bald cypress-tupelo swamp habitat within the study area. Those impoundments have contributed to decreased water quality and increased cypress and tupelo seedling mortality, which has resulted in increased habitat conversion from cypress swamp to open water.

Impoundment is particularly pronounced within the eastern portion of the LCA-ARDC study area, i.e., NE-1 and NE-2 (Figure 1). Specifically, during a recent study, water levels within the swamp habitat along the left descending bank of the ARDC never receded below 2.2 feet above mean sea level (msl), although canal water levels receded below that level (Shaffer *et al.,* 2006). Swamp impoundment is not as evident within the western portion of the LCA-ARDC study area. Installation of drainage culverts, construction of several gaps in the dredge material berms, and the confluence of Bayou Pierre with the ARDC in that area provide for hydrologic exchange between the diversion canal and the adjacent swamps.

Subsidence and salinity increases have also contributed to swamp ecosystem degradation in the LCA-ARDC study area. Land elevations decrease from subsidence, which may be caused by compaction, oxidation, and consolidation of sediments, faulting, groundwater depletion, or decreased organic deposition as a result of decreased vegetation biomass production; while land elevations increase as a result of sediment accretion, from direct sediment input from riverine sources or from organic vegetation deposition. The soil characteristics of the western Maurepas Swamp indicate a lack of riverine influence as evidenced by high soil organic matter content and low bulk density values (DeLaune et al. 1979, Hatton 1983, Messina and Conner 1998). Consequently, soil building within the Maurepas Swamp is almost exclusively a result of organic productivity (Shaffer et al. 2001, 2003, 2006, Rybczyk et al. 2002, Roberts 1985). In the swamps adjacent to the ARDC, productivity is substantially depressed compared to normal conditions (Coastal Wetlands Planning, Protection and Restoration Act [CWPPRA] Task Force

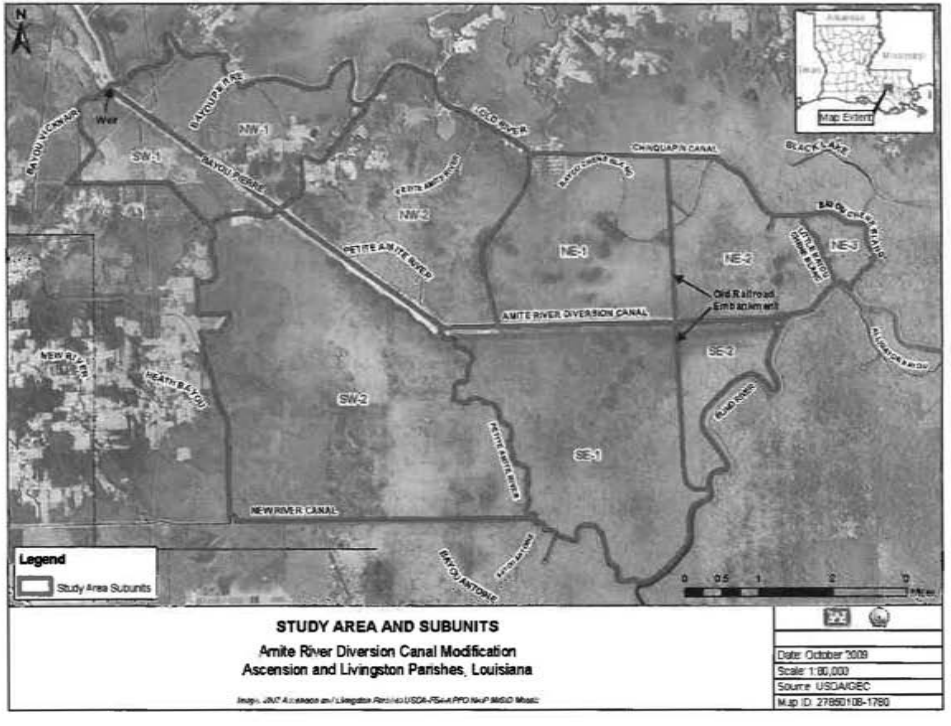


Figure 1. Study Area and Subunits

2002). Subsidence in the LCA-ARDC study area and vicinity is classified as intermediate, at about 1.1-2.0 feet per century (LCA 2004). With minimal soil building and moderately high subsidence, there has been a net lowering of ground surface elevation, doubling flood frequency over the last four decades (Thompson 2000), so that the swamps are now persistently flooded.

Saltwater intrusion has increased in this general area, partly due to net subsidence and the lack of riverine freshwater inputs. Salinities as low as three parts per thousand (ppt) can reduce growth of both bald cypress and water tupelo saplings (Pezeshki et al. 1990). Salinity, combined with flooding stress, can substantially reduce bald cypress growth. Consequently, salinity significantly contributes to swamp deterioration, particularly combined with stressors such as flooding and herbivory.

Storm surges from Lake Maurepas caused by tropical cyclones also exert a stochastic but severe stress on the swamp habitat through salinity spikes in swamp surface waters. Dredged material berms prevent higher salinity water from being flushed out of the system (CWPPRA Task Force 2002). Storm surge waters remain in the impounded swamps of the LCA-ARDC study area cumulatively increasing salinities in impounded waters and soils.

FISH AND WILDLIFE RESOURCES

The purpose of this section is to describe the principal fish and wildlife resources of the study area, and to establish their significance. Several key habitat types are described, followed by qualitative descriptions of important fish and wildlife.

Major Habitat Types

Cypress/Tupelo Swamps

The LCA-ARDC study area contains approximately 27,984 acres; the majority of which is dominated by bald cypress/tupelo swamp habitat. About 18,204 acres of that habitat type are presently impounded to various extents within the study area; that persistent flooding has resulted in the impairment of cypress/tupelo seedling establishment/regeneration (CWPPRA Task Force 2002). Cypress/tupelo regenerates well when the seedbed is moist but not flooded during the time period of seed germination and seedling establishment. Cypress/tupelo seeds cannot germinate in standing water, and seedlings must grow tall enough during dry periods for their crowns to extend above the water surface to survive flooding during the growing season. Excessive flooding will reduce regeneration even though overstory trees may still be thriving. Ultimately, the lack of regeneration due to prolonged inundation will eliminate forest cover, resulting in the conversion of swamp habitat to open water over time (CWPPRA Task Force 2002). In addition, saltwater intrusion from storm events has stressed the swamp habitat along the Blind River.

Cypress swamps in the project area provide substantial fish and wildlife values. Wildlife species typical of cypress swamps include green tree frog, bullfrog, mud and musk turtles, American alligator, various species of water snakes, anhinga, barred owl, northern parula, great blue heron, great egret, white ibis, and mink. Often surrounding backwater lakes, these areas also provide

essential habitat for aquatic species when inundated.

In addition to bald cypress and water tupelo, Drummond red maple, green ash, and various oak species are also found in the cypress/tupelo swamp habitat within the LCA-ARDC study area, with Drummond red maple and green ash comprising sub-dominant midstory species (Conner and Day 1976; Hoeppner 2008; Shaffer et al. 2003). Scrub species, including black willow, wax myrtle, and common buttonbush are sporadically present, particularly in areas with diminished canopy cover caused by impaired health or mortality of overstory species. Shrub-scrub swamps provide important nesting habitat for colonial wading birds as well as various species of aquatic wildlife.

Bottomland Hardwoods

Bottomland hardwoods are present along several ridge remnants that run through the LCA-ARDC study area. These ridges are mostly near the mid-point of the east-west stretch of the ARDC. Dominant tree species in those areas include Drummond red maple, green ash, laurel oak, water oak, sweet gum, sugarberry, American elm, and Chinese tallow. The areas between the ridges and the swamp show a transition in species including green ash, Drummond red maple, black willow, bald cypress, and water tupelo. Wax myrtle, rough-leaf dogwood, black willow, Chinese tallow, Chinese privet, yaupon, and deciduous holly typically dominate the shrub stratum. Vines such as poison ivy, greenbriars, pepper vine, and trumpet creeper are present. In addition, an old railroad grade and several earthen levees run through the LCA-ARDC study area with similar habitats.

Bottomland hardwood forests typically provide high wildlife habitat values to a variety of species, including amphibians such as the Gulf coast toad and Cope's gray tree frog; reptiles such as the copperhead and green anole; many species of birds, including wood duck, barred owl, pileated woodpecker, red-shouldered hawk, Acadian flycatcher, Swainson's Warbler and northern parula; and mammals including white-tailed deer, swamp rabbit, gray fox, bobcat, raccoon, opossum, and squirrels. In addition to terrestrial wildlife, many species of fish utilize flooded bottomland hardwoods as well; some species are specifically adapted for spawning in these backwater flood plains.

Open Water

Open water areas are distributed throughout the LCA-ARDC study area and include the ARDC; the Amite, Petite Amite, and Blind Rivers; Bayous Pierre and Chene Blanc; and the Choupique Canal. Submerged aquatic vegetation communities within the LCA-ARDC study area are largely confined to areas of higher flow. This includes natural waterways and natural cuts into the swamp interior. Shallow water habitats within the LCA-ARDC study area that have insufficient flow have become choked with floating vegetation, greatly limiting light penetration within the water column.

In their *2006 Water Quality Integrated Report*, the Louisiana Department of Environmental Quality indicated that water within the study area supports the designated standards for primary and secondary contact recreation, but does not support those standards for fish and wildlife

propagation. Suspected sources of impairment include mercury, total phosphorus, chloride, excessive nutrient levels, siltation, and low levels of dissolved oxygen.

Fresh Marsh

There are approximately 249 acres of fresh marsh within the LCA-ARDC study area. Shaffer et al. (2003) have shown that many of the marshes within the Maurepas Swamp exist as a transitional habitat as swamps are converting to open water areas over time. Those swamp habitats are being replaced by marsh and open water due to a number of factors including salt water intrusion (associated with hurricanes and rising sea levels), altered hydrology, impoundments, subsidence, and herbivory (Keddy et al. 2007).

Developed Areas

Developed areas comprise approximately 281 acres within the LCA-ARDC study area. Urban areas are primarily confined to the dredged material berms lining the ARDC adjacent to LA-22, and the right descending bank of the Amite River in the northwestern portion of the LCA-ARDC study area. Barren lands make up a small percentage of the LCA-ARDC study area and may include strip mines, quarries, and gravel pits. Agricultural croplands or grasslands make up approximately 469 acres of the LCA-ARDC study area and appear to be restricted to livestock pasture. These pastures are located in isolated pockets along the lower Amite River and LA-22 in the western portion of the study area.

Fishery Resources

Construction of the ARDC and dredged material berms have impeded exchange of organisms and water between the swamp and the ARDC. Accordingly, the study area is expected to provide low- to moderate-value habitat for some recreationally important fishes and shellfishes. Freshwater sport fishes likely present include white crappie, bluegill, warmouth, channel catfish, and blue catfish. Other fishes likely present include yellow bullhead, freshwater drum, bowfin, carp, buffaloes, and gars. In addition, the waterbodies and wetlands of the LCA-ARDC study area provide nursery and foraging habitats supportive of a variety of fishery species, some of which may serve as prey for other fish species.

Lantz (1970) sampled fish within the Amite River; primarily freshwater species were collected, although a few transient marine species were also collected or reported. Species collected included blue catfish, gizzard shad, spotted gar, freshwater drum, channel catfish, striped mullet, and largemouth bass. Laiche (1980) also sampled fish within the Amite River. The most abundant species collected were blacktail shiner, bullhead minnow, mosquitofish, longear sunfish, mimic shiner, blackstripe topminnow, bluegill, and longnose shiner.

Watson et al. (1981) collected 57 species of fish in the Blind River, including 43 freshwater species, 12 estuarine species, and two diadromous species. The authors suggested the confluence of the ARDC was a point of separation between the upper and lower reaches of Blind River. The lower Blind River had the greatest species diversity, primarily due to the presence of estuarine species. The low concentrations of dissolved oxygen above the ARDC could be an important

limiting factor in the distribution of fish.

Aquatic and wetland habitats in the LCA-ARDC study area also provide foraging and nursery habitat for a few economically important marine fishery species that use freshwater habitats in this area. The species expected to be found in the LCA-ARDC study area include striped mullet and Gulf menhaden.

Wildlife Resources

The coastal marshes and forested wetlands of the Lake Pontchartrain Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture (GCJV): Mississippi River Coastal Wetlands Initiative as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. The Mississippi River Coastal Wetlands Initiative area is dominated by coastal marsh, forested swamps, and seasonally flooded bottomland hardwoods that provide habitat for several species of wintering waterfowl. Wood ducks are the primary waterfowl species in forested wetlands, while other ducks (e.g., mallard, American widgeon, gadwall, blue- and green-winged teal, Northern shovelers, ring-necked ducks, and lesser scaup) use those forested habitats to a lesser degree.

Strategies to achieve the goals and objectives of the GCJV include but are not limited to: 1) maintaining the existing functions and values of those habitats and preventing additional losses and degradation of those wetlands and 2) modifying existing spoil banks and canals to restore hydrology (Wilson et al. 2002). Numerous other game birds are present in or adjacent to the study area, including American coot, rails, gallinules, common snipe, and American woodcock. Non-game bird species also utilize the study area marshes, including least bittern, pied-billed grebe, black-necked stilt, American avocet, killdeer, black-bellied plover, willet, and various species of sandpipers, gulls, and terns. The study area supports many resident and transient hawks and owls including red-shouldered hawk, barn owl, common screech owl, great horned owl, and barred owl. Winter residents include red-tailed hawk, northern harrier, and American kestrel, while the Mississippi kite, swallow-tailed kite and broad-winged hawk are common summer residents. In addition, the project area supports many species of resident and migratory passerine birds. Some neo-tropical migrants that are currently experiencing a population decline (e.g., white-eyed vireo, northern parula) are dependent on large forested acreage to successfully reproduce. Also, present are cuckoos, swifts, hummingbirds, nighthawks, woodpeckers, and the belted kingfisher.

Invasive Species

Within the LCA-ARDC study area invasive mammal species present include nutria and feral hogs. Invasive plant species present within that area include: water hyacinth, alligator weed, hydrilla, common salvinia, giant salvinia, variable-leaf milfoil, Chinese tallow, and Chinese privet. Those species displace native aquatics and degrade water and/or habitat quality. In addition, Chinese tallow is tolerant to flooding and salt stress and can establish self-replacing

monocultures that provide less foraging value to migrating birds and interrupt the natural succession of woody species (Louisiana Coastal Protection and Restoration 2008).

Threatened and Endangered Species

West Indian Manatee

Federally listed as an endangered species, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatee occurrences appear to be increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have

negatively affected this species.

On March 19, 2003, the Service and the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. The proposed project, however, does not occur within nor would it impact designated Gulf sturgeon critical habitat.

The Corps is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the Corps determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the ESA should be submitted to the Service. That request should also include the Corps' rationale supporting their determination.

Species of Special Interest

Bald Eagle

The project-area forested wetlands provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. There is one active bald eagle nest that is known to exist within the proposed project area, however, other nests may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries.

Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water in the southeastern Parishes. Areas with high numbers of nests include the north shore of Lake Pontchartrain and the Lake Salvador area. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. Bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the Bald and Golden Eagle Protection Act (BGEPA). The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may

constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at:
http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at:
http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. A copy of that determination should be provided to this office.

Colonial Nesting Birds

The proposed project would be located in an area where colonial nesting waterbirds may be present. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries. That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonial nesting birds, the following restriction on activity should be observed:

> For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

Refuges and Wildlife Management Areas

There are no U.S. Fish and Wildlife Service National Wildlife Refuges located within the LCA-ARDC study area. A portion of the state-operated Maurepas Swamp Wildlife Management Area is located within that study area. Please contact the Louisiana Department of Wildlife and Fisheries in Baton Rouge, Louisiana, (225/765-2360) for their comments regarding potential project impacts to this area.

EVALUATION METHODOLOGY

Evaluation of project-related impacts on fish and wildlife resources was aided by use of the

Wetland Value Assessment (WVA) methodology developed for the evaluation of proposed CWPPRA projects (Louisiana Coastal Wetlands Conservation and Restoration Task Force [LCWCRTF] 2006). The WVA methodology is similar to the Service's Habitat Evaluation Procedures (HEP), in that habitat quality and quantity are measured for baseline conditions and predicted for future without-project (FWOP) and future with-project (FWP) conditions. Separate habitat assessment models were used, including the Swamp and Bottomland Hardwood Community Models. Instead of the species-based approach of HEP, each model utilizes an assemblage of variables considered important to the suitability of a given habitat type for supporting a diversity of fish and wildlife species. As with HEP, these models allow a numeric comparison of each future condition and provide a combined quantitative and qualitative estimate of project-related impacts to fish and wildlife resources.

The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each habitat type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Indices) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

The WVA methodology was initially developed in 1991 by the CWPPRA Environmental Work Group (LCWCRTF 2006). Initially, emergent marsh habitat models were developed for fresh, intermediate, brackish and saline marsh types. Subsequently, models were also developed for swamps, barrier islands, barrier headlands, and coastal forested ridges. The habitat variable-habitat suitability relationships within the WVA models have not been verified by field experiments or validated through a rigorous scientific process. However, the variables were originally derived from HEP suitability indices taken from species models for species found in that habitat type. It should also be noted that some aspects of the WVA have been defined by policy and/or functional considerations of CWPPRA. However, habitat variable-habitat suitability relationships are, in most cases, supported by scientific literature and research findings. In other cases, best professional judgment by a team of fisheries biologists, wildlife biologists, ecologists, and university scientists may have been used to determine certain habitat variable-habitat suitability relationships. In addition, the WVA models have undergone a refinement process and habitat variable-habitat suitability relationships, HSIs, and other model aspects are periodically modified as more information becomes available regarding coastal fish and wildlife habitat suitability, coastal processes, and the efficacy of restoration projects being evaluated.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The CWPPRA swamp WVA model used consists of four variables: 1) stand structure; 2) stand maturity; 3) water regime; and 4) mean

high salinity during the growing season. The bottomland hardwood WVA model consists of seven variables: 1) tree species association; 2) stand maturity; 3) understory/midstory; 4) hydrology; 5) size of contiguous forested area; 6) suitability and traversability of surrounding land uses; and 7) disturbance.

Using the WVA methodology, impact assessments were conducted by the Habitat Evaluation Team (HET), which included representatives from the Service, the Corps, Office of Coastal Protection and Restoration, GEC, Southeast Louisiana University, and Taylor Engineering. To assess impacts the HET used habitat information collected during June and July 2009 field inspections, surveys, expert opinions, knowledge of the area, experience with similar projects, Digital Ortho-quarter Quadrangle aerial photographs (DOQQ), and hydraulics and hydrology modeling information.

Those elements were used in conjunction with the above-discussed mathematical models to compute an HSI value for each target year (TY). Target years identified within the LCA-ARDC WVA model runs include: TY0, TY1, TY10, TY25, and TY50.

The product of an HSI and the acreage of available habitat for a given target year is known as the Habitat Unit (HU). The HU is the basic unit for measuring project effects on fish and wildlife habitat. Future HUs change according to changes in habitat quality and/or quantity. Results are annualized over the project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type.

The seven alternatives within the LCA-ARDC Final Array were evaluated: Alternative 33 (NE-1/NE-2), Alternative 34 (SE-1/SE-2), Alternative 35 (SE-1), Alternative 36 (NE-1/NE-2, SE-1/SE-2), Alternative 37 (SE-1/SE-2, SE-1), Alternative 38 (NE-1/NE-2, SE-1), and Alternative 39 (NE-1/NE-2, SE-1/SE-2 – All Subunits Combined). Prior to running the WVA analysis, the benefit areas associated with each alternative were designated as either primary impact areas or secondary impact areas. For purposes of the WVA, the Service assumed that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments, while the secondary impact areas would receive lesser benefits.

Subsequent to the mapping of primary and secondary impact areas for each alternative, WVAs were run for each habitat type (i.e., degraded swamp/fresh marsh, 10 years to convert to marsh, 20-30 years to convert to marsh, and 30-50 years to convert to marsh) present within those areas. Once benefits were calculated, adverse temporary and permanent impacts to swamp and bottomland hardwood habitats associated with construction of the bank openings, conveyance channels, and dredged material placement were calculated. The change in AAHUs for each FWP scenario, compared to FWOP project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type.

The WVA initial analysis was completed on the primary and secondary impact areas for all alternatives under the low sea level rise (SLR) scenario. As requested by the Corps, additional WVAs were later run to quantify impacts under the intermediate and high SLR scenarios for the Tentatively Selected Plan and the National Ecosystem Restoration Plan. A combined total of

168 WVA evaluations were completed.

The Project Information Sheet (including assumptions used by the HET) and the WVA summary sheet for the LCA-ARDC project are presented in Appendix A and B, respectively. The complete WVA analysis can be obtained from the Service's Lafayette, Louisiana Ecological Services Office upon request.

FUTURE WITHOUT-PROJECT FISH AND WILDLIFE RESOURCES

Under future without-project conditions, the current problems associated with altered hydrology are expected to continue. The swamp habitat surrounding the ARDC will likely continue to degrade, resulting in the eventual conversion from a freshwater swamp to open water. The lack of hydrologic connectivity would result in the continued impoundment of the project-area swamp, with an associated reduction in canopy cover, degradation of water quality, and transition of swamp habitat to marsh, with the eventual conversion to open-water habitat. Storm surges from tropical cyclone events would increase salinity levels and the frequency of saltwater inundation is expected to increase with relative sea level rise (RSLR).

The lack of freshwater, sediments, and nutrients would continue to reduce tree vigor and growth, increase tree mortality, increase the presence of invasive species, and reduce ecological functions. In addition, the assumed RSLR, would exacerbate swamp degradation in the future.

The anticipated conversion of swamp habitats to marsh and open water would result in the loss of wetland values and functions. While the Service recognizes the ecological importance of freshwater marshes, most of the marshes present within the LCA-ARDC study area are present as a transitional habitat, as swamps convert to open water, and are the result of habitat deterioration and conversion, rather than healthy swamp/marsh interfaces. Keddy et al. (2007) reports that the vast majority of the Maurepas Swamp is typical of swamps identified as either nutrient poor and stagnant or near-continuously flooded. Flood durations in the Maurepas Swamp have doubled, on average, over the past half-century (Thomson et al. 2002). The flooding and impoundment within the study area prevents seed germination and recruitment and, as a result, swamps are converting to marsh and open water.

Keddy et al. (2007) identify priority actions for habitat restoration within the Maurepas Swamp. One such recommendation addresses the re-establishment of sheet flow via removal or gapping of spoil banks and road and railroad beds. They explain that sheet flow (or shallow water flow over the surface of the soil) was, most likely, the principle way in which water and nutrients moved through this system. Now, however, the presence of man-made hydrologic barriers impedes sheet flow. Canals decrease overbank flooding and accelerate the flow of water, sediment, and nutrients out of the area, while spoil banks and other such man-made features block sheet flow. Implementation of the proposed project would restore an historic ecosystem and increase the fish and wildlife habitat values of the project area.

DESCRIPTION OF NATIONAL ECOSYSTEM RESTORATION PLAN

Alternative 39 (Figure 2) has been identified as the NER and the best plan for ecosystem

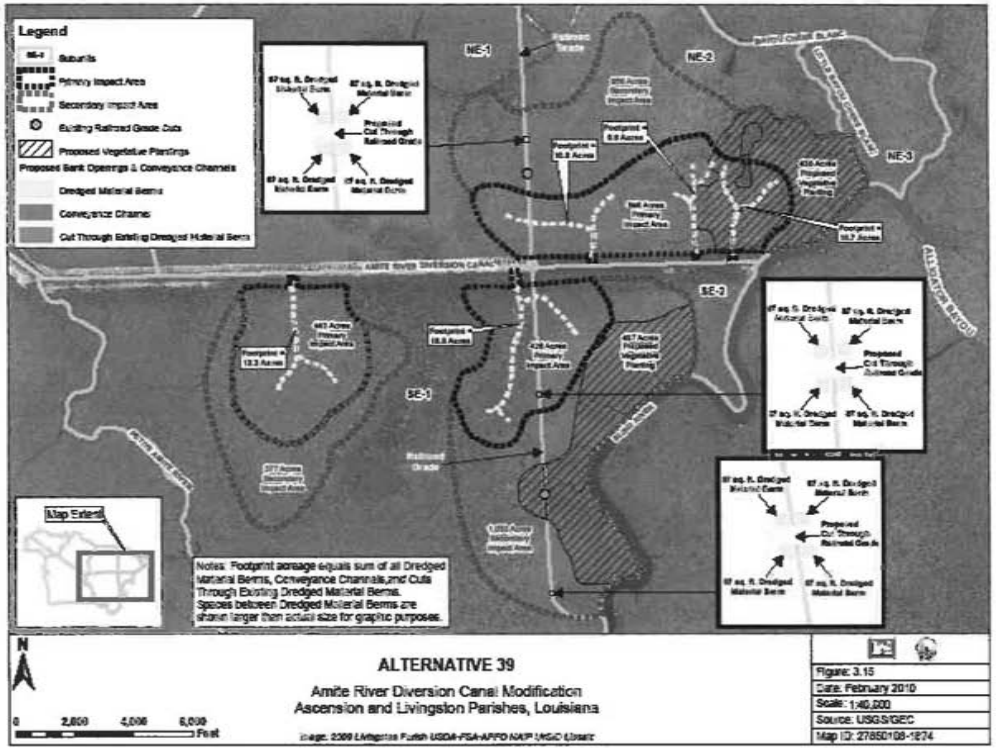


Figure 2. Alternative 39

restoration in the study area. That plan includes three areas for restoration in the final array, including two that have a critical need, and have begun converting from swamp to marsh, and a third less critical area that is expected to begin conversion in the next 20-30 years. Due to funding limitations and the risk of losing authorization, however, Alternative 39 has not been designated as the tentatively selected plan (TSP).

Features of Alternative 39 include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
- One opening and one conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (9.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps would be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately two miles south of the ARDC.
- Vegetative plantings of bottomland hardwood/swamp tree species on 9.9 acres of dredged material berms.
- Vegetative plantings of swamp tree species within 925 acres of the swamp floor.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, were designed to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile.

The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

EVALUATION OF NATIONAL ECOSYSTEM RESTORATION PLAN

Alternative 39 includes all of the most critical areas within the Maurepas Swamp basin, establishes the greatest amount of hydrologic connectivity of all of the alternatives, is cost-effective while providing the most benefits, and is a best-buy plan. Accordingly, the Service fully supports Alternative 39 as the NER plan and believes it best represents the long term restoration need for the area.

The WVA evaluations conducted on all alternatives within the final array show that the highest

net benefits to fish and wildlife habitats occur with implementation of Alternative 39. Specifically, the WVA analysis indicates that the NER for the LAC-ARDC project would result in net gains of 1,602, 1,516, and 1,452 AAHUs under the low, intermediate, and high SLR scenarios, respectively.

Swamp habitat for fish and wildlife species would be restored, mimicking as closely as possible, conditions which occurred historically in the area. Implementation of Alternative 39 would restore the hydrologic connectivity between NE-1, NE-2, SE-1, and SE-2 within the ARDC. That alternative would improve the hydrologic connectivity between the ARDC and approximately 3,881 acres in both the primary and secondary impact areas, restore approximately 290 acres of swamp, and create approximately 9.9 acres of upland habitat from dredged material placement. Restored hydrologic connections would: 1) increase the nutrient and sediment input to approximately 1,515 acres within the primary impact area, 2) increase acreage of high-quality swamp habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements, and 3) increase vegetative growth and productivity. In addition, when compared to the future without project scenario, implementation of this alternative would significantly reduce the likelihood of 3,881 acres of existing swamp habitat converting to marsh and eventual open water habitat over the life of the project.

DESCRIPTION OF TENTATIVELY SELECTED PLAN

Because the NER plan (Alternative 39) cannot be constructed within the currently authorized cost cap, Alternative 33 (Figure 3) was chosen as the TSP.

Alternative 33 includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, were designed to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile.

The material dredged from the existing berms would be placed along the swamp-side of the

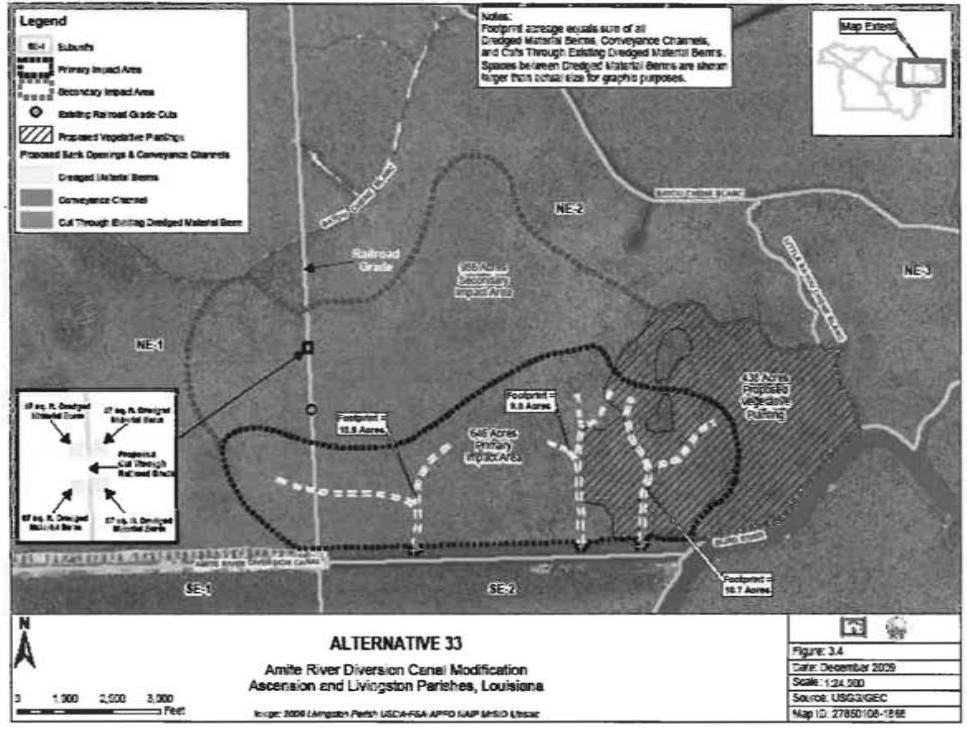


Figure 3. Alternative 33

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excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

EVALUATION OF TENTATIVELY SELECTED PLAN

Alternative 33 addresses the most-highly degraded portion of the study area (NE-2), is considered cost effective, and can be implemented within the current cost cap. Implementation of that alternative, however, would not address the restoration needs within SE-1 and SE-2. Implementation of Alternative 33 would, therefore, result in similar benefits as expected under Alternative 39, but to a lesser degree. Specifically, Alternative 33 would improve the hydrologic connectivity between the ARDC and approximately 1,602 acres in both the primary and secondary impact areas, restore approximately 144 acres of swamp, and create approximately 5.0 acres of upland habitat from dredged material placement. The WVA analysis indicates that the TSP for the LAC-ARDC project would result in net gains of 679, 640, and 610 AAHUs under the low, intermediate, and high SLR scenarios, respectively.

FISH AND WILDLIFE CONSERVATION AND MITIGATION MEASURES

Swamp habitats are considered by the Service to be aquatic resources of national importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and interjurisdictional fisheries). Because of the Services' close coordination with the USACE on this project, and because the project is expected to have an overall benefit to the LCA-ARDC study area, the Service has no conservation measures to offer at this time.

SERVICE POSITION AND RECOMMENDATIONS

The TSP will benefit the fish and wildlife resources of the LCA-ARDC area by providing freshwater, nutrients, and sediments to the study area thus facilitating sediment deposition, increase organic production, increase biological productivity, and reduce conversion of swamp habitat to open water. Approximately 679 AAHUs and 1,602 net acres of swamp habitats would benefit by the proposed project at the end of the project life. The Service supports implementation of Alternative 33 provided the following fish and wildlife recommendations are implemented concurrently with project implementation:

1. If authorized funding limits for this project are increased the Service recommends that Alterative 39 be reconsidered as the potential future TSP.

2. Prioritize those measures that are contained in the NER plan that are not included within the TSP based on cost-effectiveness. In addition, advertise the most cost-effective measures in the NER plan that are missing from the TSP as additive alternates if funds for this project are authorized by Congress and the project is advertised for construction bids.

3. If a proposed project feature is changed significantly or is not implemented within one

year of the Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with our office to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their critical habitat.

4. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. A qualified biologist should inspect the proposed work site for the presence of undocumented wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies, and October through mid-May for bald eagles).

5. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

6. Because bald eagles are known to nest within the proposed study area, we recommend that an evaluation be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary and those results should be forwarded to this office.

7. Land clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

8. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on the all work addressed in those reports.

9. A report documenting the status of implementation, maintenance and adaptive management measures should be prepared every three years by the managing agency and provided to the Corps, the Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Office of Coastal Protection and Restoration, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

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APPENDIX A

PROJECT INFORMATION SHEET WITH ASSUMPTIONS FOR LCA-ARDC

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Wetland Value Assessment Project Information Sheet
December 2009

Draft

Project Name: Louisiana Coastal Area – Amite River Diversion Canal (ARDC) Modification

Project Type(s): Swamp restoration, hydrologic restoration, and vegetative planting

Sponsoring Agency: U.S. Army Corps of Engineers (Corps) and Louisiana Department of Natural Resources

Preparer of Wetland Value Assessment (WVA) information sheet: Karen Soileau
Information found in this project information sheet was obtained primarily from the Draft Feasibility Report appendix (CPE 2005 and 2007).

Project Area: The project area is situated along the ARDC in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The project area is focused around the impaired baldcypress-tupelo swamp stands adjacent to the ARDC, extending northward and southward of the canal in the western portion of the Maurepas Swamp, located within the Pontchartrain Basin.

Project area boundaries were developed and delineated based on hydrologic features of the area suspected of being influenced by the Amite River Diversion Canal Modification Project. For planning purposes, the project area was further divided into nine sub-areas. Those sub-areas are defined by topographic high points (e.g., spoil banks, relict railroad grade, road embankments) or natural and artificial channels (e.g., rivers, canals) that would serve to impede or intercept hydrologic flows.

Problem: The project are includes the ARDC, a 10.6-mile-long flood control channel between the Amite and Blind Rivers. Dredged material excavated during channel construction was deposited in spoil banks on either side of the canal. The construction of the ARDC and its associated spoil banks, and the resulting impoundment, channelization, surge-related saltwater intrusion, and the loss of freshwater, sediments, and nutrients from the Amite River have all caused significant adverse impacts to the area, resulting in poor swamp health and ecosystem degradation in the western Maurepas Swamp.

Goal: The goal of the ARDC Modification Project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, so as to contribute toward achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

Objectives:

1. Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the

exchange of freshwater, sediments and nutrients over the 50-year period of analysis.

2. Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.

3. Facilitate natural hydrologic cycles within the study area over the 50- year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.

4. Improve fish and wildlife habitat within the study area of the 50-year period of analysis.

Project Features:

1. Freshwater Reintroduction – Restoring processes that input freshwater, nutrients, and sediments are essential for establishing sustainable coastal swamp systems. The implementation of freshwater reintroduction measures that establish hydrologic connectivity between study area waterbodies and the adjacent swamp habitat could nourish existing swamp habitat to increase productivity and restore areas that have converted to freshwater marsh or open water, reintroduce sediments and nutrients throughout the ecosystem, and allow aquatic organisms access to previously unavailable habitats. The benefits that such reintroductions produce increase over time and continue as long as the reintroduction is operated and maintained. Additionally, freshwater reintroductions can be adaptively managed to respond to environmental changes and optimize benefits.

2. Habitat Restoration – The majority of the Maurepas swamp is stressed as a result of hydrologic alteration and seems to be on a trajectory of slow degradation leading to a gradual conversion to marsh and open water (Hoeppner et al. 2007). Without restoration, the factors and processes that are contributing to stress and deterioration of the swamps in the vicinity of the ARDC will continue and will result in loss of the swamp, with succession to open water. The wetland loss rates for the Coast 2050 Amite/Blind Rivers mapping unit (which contains the study area) for 1974-90 were estimated by the Corps to be 0.83 percent per year for swamp habitat, and 0.02 percent per year for fresh marsh. Based on these rates, approximately 50 percent of swamp and 1.2 percent of fresh marsh will be lost within 60 years (CWPPRA Task Force 2002). Additionally, the Corps determined that, based on the low tree density, degraded condition, and expectation for mortality, the majority of swamp habitat within the study area will degrade to less than 33 percent canopy cover within 20 years (U.S. Army Corps of Engineers 2004). Under the continued influence of these conditions, tree mortality will continue to increase and tree density will continue to decline, until most swamp habitat in the vicinity of the ARDC converts to fresh marsh. Monitoring studies conducted for the CWPPRA PPL 12 proposal indicated that conversion of baldcypress-tupelo swamp to fresh marsh is already occurring in

the study area, particularly north of the ARDC in subunit NE-2 (CWPPRA Task Force, 2002). Additionally, the monitoring results indicate that many areas of fresh marsh in the greater southern Maurepas Swamp have converted to fragile spikerush flotant, which is particularly susceptible to nutrient starvation and fragmentation. Consequently, it is expected that the vast majority of swamp habitat adjacent to the ARDC would convert to open water rather than stable marsh habitat without implementation of the proposed project.

LOW SEA LEVEL RISE SCENARIO ASSUMPTIONS

Primary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (USDA 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should continue to improve habitat conditions within the area. Accordingly, we anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our WVA data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year ; tupelo et al = 0.08 inches per year). Basal area was again estimated utilizing data collected by Southeast Louisiana University and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future without project scenario, basal areas decreased from

target year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas will receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees in the canopy was increased over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within this portion of the project area are permanently flooded and have no flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario and we anticipate the project area to remain permanently flooded with no flow/exchange.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area will receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area will receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Because the subject area is impounded with no flow/exchange we expect the salinity to increase over time. Thus, we assumed

that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 parts per thousand [ppt] from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of

the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year; tupelo et al = 0.08 inches per year). Basal area was again estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the

tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from target year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the high benefit areas will receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are semi-permanently flooded and have low

flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area will receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area will receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the

future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected

to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year; tupelo et al = 0.08 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 20 year to marsh habitat type, as

compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decreased from target year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas will receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area will receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area will receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL

12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected

to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future <u>Without</u> Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.15 inches per year; tupelo et al = 0.10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from target year 0 to 25 and decrease significantly between target year 25 and 50 due to the projected loss of canopy cover.

Future <u>With</u> Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA and information provided by Mr. Bernard Wood. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas will receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low),

we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area will receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area will receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project

Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

Secondary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project

construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (USDA 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should continue to improve habitat conditions within the area. Accordingly, we

anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our WVA data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future <u>Without</u> Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year; tupelo et al = 0.08 inches per year). Basal area was again estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the

tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future without project scenario, basal areas decreased from target year 0 to 50.

Future <u>With</u> Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas will receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960) and is assumed to result in similar conditions as the 155 acre fresh marsh high benefit area since vegetated plantings are proposed.

Variable 3: Water Regime

Both *Future <u>With</u>* and *Future <u>Without</u> Project*

Target Year 0 –

At present the Maurepas swamps within this portion of the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas will also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted

1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on

existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events,

seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project

Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year; tupelo et al = 0.08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from target year 0 to 50.

Future With Project

Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas will receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average

values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas will also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition,

because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data

collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.11 inches per year; tupelo et al = 0.08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 20 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decrease from target year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas will receive benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the

primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to

see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas will also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was

designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future Without Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = 0.15 inches per year; tupelo et al = 0.10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from target year 0 to 25 and decrease significantly between target year 25 and 50 due to the projected loss of canopy cover.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas will receive benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are

similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by using bottomland hardwood growth/basal area rates developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas swamps within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps,

and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas will also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a temporary flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps will likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced

into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

INTERMEDIATE AND HIGH SEA LEVEL RISE SCENARIO ASSUMPTIONS

Variable 1: Stand Structure

No anticipated changes to this variable (i.e., same projections as low sea level rise scenario).

Variable 2: Stand Maturity

No anticipated changes to this variable (i.e., same projections as low sea level rise scenario).

Variable 3: Water Regime

The following information was provided by George Hudson of Taylor Engineering.

RATE OF RSLR	RSLR @ 50 YEARS	WITHOUT PROJECT YEARS TO PERMANENT INUNDATION	WITH PROJECT YEARS TO PERMANENT INUNDATION	WITH PROJECT WITH 8 MM/YR ACCRETION YEARS TO PERMANENT INUNDATION
Low Rate	1.5 feet	14 years	40 years	150 years
Intermediate Rate	1.9 feet	12.5 years	31 years	58 years
High Rate	3.2 feet	8 years	17 years	26 years

Variable 4: Mean High Salinity During the Growing Season

The study area is normally dominated by the fresh headwater flow of the Amite River, with some additional freshwater input from the Blind River. This area also has episodic salinity pulses from tropical storms and extreme droughts, such as the drought of 1998-2000.

As RSLR occurs, the isohalines will migrate toward the study area, but still will be hindered somewhat by the freshwater input. As sea level rises [such as in the low (1.5 feet in 50 years) to medium (1.9 feet in 50 years) estimates], the tropical events and droughts will allow for increased saltwater intrusion into the area. The spikes will be higher and there will be more volume of saltwater entering the study area. As sea level continues to increase [as for the high (3.2 feet in 50 years)] this saltwater intrusion will increase, likely curvilinearly, perhaps exponentially.

The salinity (V4) term in the Swamp WVA accounts for the impact of salinity on the estimate of health for the system. V4 is the mean average high salinity, basically the average of the top 33% of the readings. As salinity increases due to RSLR, the spikes and volume of salt water will increase. However, due to the domination of the fresh water in the Amite and Blind Rivers, this area will still likely be fresh during normal conditions, even with the high estimate of RSLR. Therefore, even if the top 10% of the readings are higher, the next 23% (rest of the 33%) would likely be about the same. Thus, there would be some "watering down" of the spikes for the WVA evaluation. The key to this logic is the freshwater input of the 2,200 square miles of the Blind River and Amite River watersheds. For the FWP, the connectivity and the normal freshwater input that follows a tropical event would improve conditions by flushing the salt water out of the system, rather than letting it linger and increase soil salinities.

The WVA Team developed estimates for the V4 Salinity term for the low (1.5 ft) RSLR estimate (see the following table). Using this as a basis, a relationship between salinity increase and RSLR was determined. For the low FWOP, the Team determined that the V4 term would go from 1.2 to 1.4 ppt with a RSLR increase of 1.5 feet. We assume a linear increase in RSLR, thus the estimates for the WVA years (1, 10, and 25) are simply estimated by dividing the 50-year estimate by the appropriate year. The estimate of 0.133 ppt per foot of RSLR [(1.4-1.2)/1.5] was developed from the low estimate.

For the medium RSLR estimate, a 0.133 ppt per foot of RSLR was applied to the estimate of RSLR.

For year 50 in the high RSLR estimate, the estimate was doubled to 0.266 ppt per foot of RSLR. The reason for this increase is that when the sea level increases to about the 1.5-1.9 foot range, the saltwater intrusion would be much more pronounced as the increase would be curvilinear or even exponential. Likely, the 1.0 ppt isohaline may be very close to the study area in Lake Maurepas, even during normal conditions.

The FWP for both medium and high RSLR was estimated based on the FWOP and WVA Technical discussions.

Salinity estimates for three RSLR senarios, as based on Low RSLR.

	Low RSLR				Med RSLR				High RSLR			
	V4 Salinity				V4 Salinity				V4 Salinity			
Year	FWOP		FWP		FWOP		FWP		FWOP		FWP	
	RSLR		Primary Impact Area	Secondary Impact Area	RSLR		Primary Impact Area	Secondary Impact Area	RSLR		Primary Impact Area	Secondary Impact Area
0	0.00	1.20	1.20	1.20	0.00	1.20	1.20	1.20	0.00	1.20	1.20	1.20
1	0.03	1.20	0.90	1.00	0.04	1.21	0.90	1.00	0.06	1.21	0.90	1.00
10	0.30	1.20	0.90	1.00	0.38	1.25	0.90	1.00	0.64	1.29	0.90	1.00
25	0.75	1.30	1.00	1.10	0.95	1.33	1.00	1.10	1.60	1.41	1.20	1.30
50	1.50	1.40	1.20	1.30	1.90	1.45	1.20	1.30	3.20	2.05	1.80	1.90

FWOP

Low	Determined in WVA Technical Meetings
Medium	0.2 PPT / 1.5 ft RSLR = 0.133 ppt / foot of RSLR
High	Double rate from from year 25 to year 50 on High SLR - 0.266 ppt increase per foot of RSLR.

FWP

LOW	Determined in WVA Technical Meetings
Medium	Estimated Based on FWOP and WVA Technical Meetings
High	Estimated Based on FWOP and WVA Technical Meetings

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APPENDIX B

WVA SUMMARY SHEET FOR LCA-ARDC

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Low SLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	70.08	AAHUs	3544.07 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.32	AAHUs	1781.12 CHUs
• 10 Years to Marsh Secondary Impact Area	=	73.46	AAHUs	3673.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	180.49	AAHUs	9414.31 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	262.42	AAHUs	13521.00 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	37.29	AAHUs	1864.40 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	40.00	AAHUs	2001.10 CHUs
• Spoil Bank Permanent Impacts	-	-0.55	AAHUs	-27.80 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• Fresh Marsh Permanent Impacts	-	-1.71	AAHUs	-85.42 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.71	AAHUs	-35.53 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-4.70	AAHUs	-235.13 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-1.86	AAHUs	-92.86 CHUs
TOTAL	=	679.46	AAHUs	33979.16 CHUs

Alternative 34

• Fresh Marsh Secondary Impact Area	=	46.79	AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	36.96	AAHUs	1848.16 CHUs
• 10 Years to Marsh Secondary Impact Area	=	29[illegible]	AAHUs	1482[illegible] CHUs
• 20-30 Years to Marsh Primary Impact Area	=	81.39	AAHUs	4063.76 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	53.63	AAHUs	2681.73 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	67.25	AAHUs	3362.63 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	5.71	AAHUs	285.33 CHUs
• Spoil Bank Permanent Impacts	-	-0.62	AAHUs	-31.05 CHUs
• Spoil Bank Temporary Impacts	-	-0.33	AAHUs	-16.81 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.28	AAHUs	-14.21 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-1.67	AAHUs	-83.62 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-5.75	AAHUs	-287.66 CHUs
TOTAL	=	666.58	AAHUs	29628.75 CHUs

Alternative 35

• 20-30 Years to Marsh Primary Impact Area	=	143.92	AAHUs	7196.09 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	110.96	AAHUs	5548.85 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	56.56	AAHUs	2802.27 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	26.00	AAHUs	1299.80 CHUs
• Spoil Bank Permanent Impacts	-	-0.41	AAHUs	-20.70 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-2.84	AAHUs	-127.14 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-2.16	AAHUs	-107.87 CHUs
TOTAL	=	333.80	AAHUs	16879.91 CHUs

Alternative 36

• Fresh Marsh Primary Impact Area	=	70.63	AAHUs	3544.07 CHUs
• Fresh Marsh Secondary Impact Area	=	46.79	AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	74.19	AAHUs	3709.50 CHUs
• 10 Years to Marsh Secondary Impact Area	=	367.18	AAHUs	18355.93 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	270.78	AAHUs	13538.17 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	310.76	AAHUs	15512.74 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	94.64	AAHUs	4727.03 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	49.41	AAHUs	2470.38 CHUs
• Spoil Bank Permanent Impacts	-	-1.17	AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	-	-0.54	AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	-	-1.33	AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.99	AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-5.67	AAHUs	-347.70 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-7.55	AAHUs	-377.55 CHUs
TOTAL	=	1266.04	AAHUs	63401.93 CHUs

Alternative 37

• Fresh Marsh Secondary Impact Area	=	46.79	AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	36.96	AAHUs	1848.16 CHUs
• 10 Years to Marsh Secondary Impact Area	=	293.70	AAHUs	14686.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	220.30	AAHUs	11009.85 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	170.91	AAHUs	8540.80 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	126.30	AAHUs	6284.90 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	35.38	AAHUs	1769.03 CHUs
• Spoil Bank Permanent Impacts	-	-1.05	AAHUs	-51.75 CHUs
• Spoil Bank Temporary Impacts	-	-0.54	AAHUs	-27.19 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.28	AAHUs	-14.21 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-4.21	AAHUs	-210.[illegible] CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-7.91	AAHUs	-396.63 CHUs
TOTAL	=	922.17	AAHUs	46108.66 CHUs

Alternative 38

• Fresh Marsh Primary Impact Area	=	70.88	AAHUs	3544.07 CHUs
• 10 Years to Marsh Primary Impact Area	=	35.32	AAHUs	1781.12 CHUs
• 10 Years to Marsh Secondary Impact Area	=	73.46	AAHUs	3673.10 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	333.41	AAHUs	16670.40 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	363.40	AAHUs	18169.95 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	85.33	AAHUs	4266.67 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	66.02	AAHUs	3300.63 CHUs
• Spoil Bank Permanent Impacts	-	-0.97	AAHUs	-48.30 CHUs
• Spoil Bank Temporary Impacts	-	-0.45	AAHUs	-22.76 CHUs
• Fresh Marsh Permanent Impacts	-	-1.33	AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.71	AAHUs	-35.53 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-7.35	AAHUs	-362.26 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-3.96	AAHUs	-197.76 CHUs
TOTAL	=	1013.06	AAHUs	50603.09 CHUs

Alternative 39

• Fresh Marsh Primary Impact Area	=	70.88	AAHUs	3544.07 CHUs
• Fresh Marsh Secondary Impact Area	=	46.79	AAHUs	2339.32 CHUs
• 10 Years to Marsh Primary Impact Area	=	74.19	AAHUs	3709.50 CHUs
• 10 Years to Marsh Secondary Impact Area	=	367.18	AAHUs	18356.93 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	414.59	AAHUs	20724.26 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	423.33	AAHUs	21161.69 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	152.99	AAHUs	7649.59 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	72.43	AAHUs	7772.16 CHUs
• Spoil Bank Permanent Impacts	-	-1.59	AAHUs	-79.39 CHUs
• Spoil Bank Temporary Impacts	-	-0.77	AAHUs	-38.57 CHUs
• Fresh Marsh Permanent Impacts	-	-1.33	AAHUs	-66.40 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.99	AAHUs	-49.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-8.92	AAHUs	-[illegible] CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-8.71	AAHUs	-[illegible] CHUs
TOTAL	=	1801.64	AAHUs	90081.84 CHUs

Intermediate SLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67 CHUs
• 10 Years to Marsh Primary Impact Area	=	34.64	AAHUs	1736.03 CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.45	AAHUs	3372.28 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	187.48	AAHUs	9374.02 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	220.19	AAHUs	11624.65 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.56	AAHUs	1328.14 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.01	AAHUs	1662.65 CHUs
• Spoil Bank Permanent Impacts	-	-0.55	AAHUs	-27.80 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.85	AAHUs	-42.60 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-4.37	AAHUs	-218.27 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-1.76	AAHUs	-85.17 CHUs
TOTAL	=	640.32	AAHUs	32015.90 CHUs

Alternative 34

• Fresh Marsh Secondary Impact Area	=	42.53	AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	73.75	AAHUs	3687.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	357.11	AAHUs	17855.58 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	263.18	AAHUs	13159.05 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	287.90	AAHUs	14395.03 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	95.10	AAHUs	4604.95 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	46.80	AAHUs	2340.15 CHUs
• Spoil Bank Permanent Impacts	-	-1.17	AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	-	-0.54	AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.99	AAHUs	-49.80 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-5.69	AAHUs	-285.06 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-7.41	AAHUs	-370.51 CHUs
TOTAL	=	1190.64	AAHUs	64638.00 CHUs

Alternative 35

• 20-30 Years to Marsh Primary Impact Area	=	143.92	AAHUs	7196.09 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	110.96	AAHUs	5548.85 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	56.56	AAHUs	2802.27 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	26.00	AAHUs	1299.80 CHUs
• Spoil Bank Permanent Impacts	-	-0.41	AAHUs	-20.70 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-2.84	AAHUs	-127.14 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-2.16	AAHUs	-107.87 CHUs
TOTAL	=	333.80	AAHUs	16879.91 CHUs

Alternative 36

• Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67 CHUs
• Fresh Marsh Secondary Impact Area	=	42.53	AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	73.75	AAHUs	3687.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	357.11	AAHUs	17855.58 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	263.18	AAHUs	13159.05 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	287.90	AAHUs	14395.03 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	95.10	AAHUs	4604.95 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	46.80	AAHUs	2340.15 CHUs
• Spoil Bank Permanent Impacts	-	-1.17	AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	-	-0.54	AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.99	AAHUs	-49.80 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-5.69	AAHUs	-285.06 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-7.41	AAHUs	-370.51 CHUs
TOTAL	=	1190.64	AAHUs	64638.00 CHUs

Alternative 37

• Fresh Marsh Secondary Impact Area	=	42.53	AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	73.75	AAHUs	3687.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	357.11	AAHUs	17855.58 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	263.18	AAHUs	13159.05 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	287.90	AAHUs	14395.03 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	95.10	AAHUs	4604.95 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	46.80	AAHUs	2340.15 CHUs
• Spoil Bank Permanent Impacts	-	-1.17	AAHUs	-58.65 CHUs
• Spoil Bank Temporary Impacts	-	-0.54	AAHUs	-27.19 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.99	AAHUs	-49.80 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-5.69	AAHUs	-285.06 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-7.41	AAHUs	-370.51 CHUs
TOTAL	=	1190.64	AAHUs	64638.00 CHUs

Alternative 38

• Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67 CHUs
• 10 Years to Marsh Primary Impact Area	=	34.64	AAHUs	1736.03 CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.45	AAHUs	3372.28 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	187.48	AAHUs	9374.02 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	220.19	AAHUs	11624.65 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.56	AAHUs	1328.14 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.01	AAHUs	1662.65 CHUs
• Spoil Bank Permanent Impacts	-	-0.55	AAHUs	-27.80 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.85	AAHUs	-42.60 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-4.37	AAHUs	-218.27 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-1.76	AAHUs	-85.17 CHUs
TOTAL	=	640.32	AAHUs	32015.90 CHUs

Alternative 39

• Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67 CHUs
• Fresh Marsh Secondary Impact Area	=	42.53	AAHUs	2126.41 CHUs
• 10 Years to Marsh Primary Impact Area	=	73.75	AAHUs	3687.31 CHUs
• 10 Years to Marsh Secondary Impact Area	=	357.11	AAHUs	17855.58 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	408.90	AAHUs	20444.99 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	373.52	AAHUs	18481.03 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	148.64	AAHUs	7432.12 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	71.42	AAHUs	3571.42 CHUs
• Spoil Bank Permanent Impacts	-	-1.59	AAHUs	-79.39 CHUs
• Spoil Bank Temporary Impacts	-	-0.77	AAHUs	-38.57 CHUs
• Fresh Marsh Permanent Impacts	-	-1.32	AAHUs	-66.22 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.92	AAHUs	-45.92 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-8.08	AAHUs	-403.96 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-8.02	AAHUs	-[illegible] CHUs
TOTAL	=	1515.53	AAHUs	75776.57 CHUs

High SLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	58.98	AAHUs	2949.06 CHUs
• 10 Years to Marsh Primary Impact Area	=	31.57	AAHUs	1578.76 CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.09	AAHUs	3354.57 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	170.00	AAHUs	8498.95 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	226.01	AAHUs	11390.35 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	28.42	AAHUs	1,420.82 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.46	AAHUs	1873.02 CHUs
• Spoil Bank Permanent Impacts	-	-0.55	AAHUs	-27.80 CHUs
• Spoil Bank Temporary Impacts	-	-0.23	AAHUs	-11.38 CHUs
• Fresh Marsh Permanent Impacts	-	-1.20	AAHUs	-64.80 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.67	AAHUs	-31.34 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-4.16	AAHUs	-207.75 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-1.62	AAHUs	-81.71 CHUs
TOTAL	=	610.20	AAHUs	30809.94 CHUs

Alternative 34

• Fresh Marsh Secondary Impact Area	=	42.01	AAHUs	2043.65 CHUs
• 10 Years to Marsh Primary Impact Area	=	66.49	AAHUs	3324.36 CHUs
• 10 Years to Marsh Secondary Impact Area	=	332.10	AAHUs	16734.90 CHUs
• 20-30 Years to Marsh Primary Impact Area	=	273.27	AAHUs	13653.39 CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	319.83	AAHUs	15987.31 CHUs
• 30-50 Years to Marsh Primary Impact Area	=	147.71	AAHUs	7385.47 CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	75.58	AAHUs	3529.16 CHUs
• Spoil Bank Permanent Impacts	-	-1.59	AAHUs	-79.39 CHUs
• Spoil Bank Temporary Impacts	-	-0.77	AAHUs	-38.57 CHUs
• Fresh Marsh Permanent Impacts	-	-1.20	AAHUs	-64.80 CHUs
• 10 Years to Marsh Permanent Impacts	-	-0.87	AAHUs	-43.74 CHUs
• 20-30 Years to Marsh Permanent Impacts	-	-7.85	AAHUs	-393.06 CHUs
• 30-50 Years to Marsh Permanent Impacts	-	-8.87	AAHUs	-441.91 CHUs
TOTAL	=	1451.77	AAHUs	72588.63 CHUs

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APPENDIX C

NOAA FISHERIES SERVICE COORDINATION LETTER

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

FACSIMILE TRANSMITTAL FORM

NATIONAL MARINE FISHERIES SERVICE

HABITAT CONSERVATION DIVISION - BATON ROUGE BRANCH

c/o Louisiana State University, Baton Rouge, LA 70803-7535

DELIVER TO: Dr. William P. Klein, COE, PM-RS
504-862-2540
504-862-2088

FROM: Jan L. Koellen for Richard Hartman (x203)
NATIONAL MARINE FISHERIES SERVICE
(225) 389-0508x202
(225) 389-0506
jan.koellen@noaa.gov

DATE: Friday, February 20, 2009

NUMBER OF PAGES: 4 (plus transmittal form)

SUBJECT: LCA Scoping Mtgs - NMFS' letters dated 2/20/09

COMMENTS: Originals in mail & dated 2/20/09. TY. -jk

02/20/2008 13:25 FAX 9122538950S NOAA NMFS BR HCD 001/005

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

February 20, 2009 F/SER46/RH:jk
225/389-0508

Dr. William P. Klein
Environmental Compliance and Analysis Branch
New Orleans District
Department of the Army, Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Dr. Klein:

NOAA's National Marine Fisheries Service (NMFS) has received the public notice advertising a scoping meeting to be held for the Louisiana Coastal Area (LCA), Louisiana; Amite River Diversion Canal Modification Feasibility Study. According to the public notice, the U.S. Army Corps of Engineers (COE) intends to undertake a feasibility study and prepare a supplemental environmental impact statement (SEIS) to evaluate the impacts and benefits of constructing gaps in the existing dredged material banks of the Amite River Diversion Canal. The objective of gap construction would be to allow floodwaters to introduce nutrients and sediment into the western Maurepas swamp. Such nutrients and sediment would help offset wetland degradation processes currently affecting the bottomland hardwood and cypress swamp habitats in the project area. The COE has requested the public and natural resource agencies provide recommendations on: 1) the environmental problems and needs that should be addressed in the document; 2) the important resources in the project area; and, 3) reasonable restoration alternatives to be considered in the feasibility study and SEIS.

Aquatic and wetland habitats in the study area provide foraging and nursery habitat for a few economically important marine fishery species that use fresh water habitats in this area. Those species that could be expected to be found in the project area are striped mullet and Gulf menhaden. NMFS recommends the SEIS include a section titled "Fishery Resources" that identify the fisheries resources of the study area and describe the potential impacts and benefits to those resources that could be caused by gapping the spoil banks of the Amite River Diversion Canal. Potential beneficial impacts could result from: 1) facilitating the movement of marine fishery species to shallow water nursery and foraging habitats behind the spoil banks; 2) increasing the health of bottomland hardwood and swamp habitats supportive of marine fishery resources; and, 3) increasing the flow of detritus, important components of the aquatic food web, from the wetland habitats to estuarine areas closer to the Gulf of Mexico.

We appreciate the opportunity to identify resources that should be evaluated in the SEIS. If you have any questions regarding comments and recommendations provided herein, please contact

02/20/2009 13:25 FAX 9122538905 NOAA NMFS BR HCD 004/005

Mr. Richard Hartman of our Louisiana Habitat Conservation Division office at (225) 389-0508, ext 203.

Sincerely,

for Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

c:
FWS, Lafayette
EPA, Dallas
LA DNR, Consistency
F/SER46, Swafford
Files

02/20/2009 13:28 FAX 8122538805O8 NOAA NMFS BR HCD 005/005

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue, South
St. Petersburg, Florida 33701

June 18, 2010 F/SER46/RH:jk
225/389-0508

Ms. Joan Exnicios, Chief
Environmental Planning and Compliance Branch
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the four public notices dated May 21, 2010, pertaining to the Louisiana Coastal Area – Ecosystem Restoration Projects. Those public notices are variously titled:

1. Amite River Diversion Canal Modification Project, Livingston and Ascension Parishes, Louisiana.
2. Small Diversion at Convent/Blind River, St. James Parish, Louisiana.
3. Medium Diversion at White Ditch, Plaquemines Parish, Louisiana.
4. Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock

NMFS is presently reviewing Supplemental Environmental Impact Statements for each of the above identified projects. While we have significant recommendations pertaining to needed revisions to those documents, we do not expect to object to authorization or implementation of any of the above identified projects. As such, NMFS has no comments to provide on the public notices for any of the projects identified above.

We appreciate the opportunity to review and comment on these projects.

Sincerely,

for Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

c:
FWS, Lafayette, Walther
EPA, Dallas, Mick
LA DNR, Consistency, Ducote
F/SER46,-Swafford
Files

Comments from the letter dated July 1, 2010, are addressed in Appendix G.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

July 1, 2010 F/SER46/RH:jk
225/389-0508

Ms. Joan M. Exnicios, Chief
Environmental Planning and Compliance Branch
Planning, Programs, and Management Division
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the Pre-Decisional Draft Integrated Feasibility Study and Supplemental Environmental Impact Statement (SEIS) for the Louisiana Coastal Area Amite River Diversion Canal (ARDC) Modification Project, Ascension and Livingston Parishes, Louisiana. The document was transmitted for NMFS' review by letter dated May 21, 2010 from the Army Corps of Engineers, New Orleans District (NOD). The NOD's letter indicates that submittal of the document to NMFS initiates essential fish habitat (EFH) consultation as required by provisions of the Magnuson-Stevens Fishery Conservation and Management Act. It should be noted that initiation of consultation under provisions of the Magnuson-Stevens Fishery Conservation and Management Act is unnecessary as the project is neither located in an area categorized as EFH or projected to have an adverse impact on EFH.

The overall study area is located in Ascension and Livingston Parishes near Head of Island, Louisiana. The tentatively selected plan (Alternative 33) calls for excavation of three created earthen-bank openings and three bifurcated conveyance channels in the north bank of the ARDC. Dredged material from the bank openings and the conveyance channels would be side-cast in alternating berms so sheet flow is not reduced. One cut would be created in the railroad grade, approximately 0.9 mile north of the ARDC, to improve sheet flow. Vegetative planting of bottomland hardwood/freshwater swamp tree species is planned on 5.0 acres of dredged material berms. Vegetative plantings of freshwater swamp tree species is planned within 438 acres of swamp floor. The proposed action would restore more than 1,600 acres of freshwater swamp habitat, create 5.0 acres of bottomland hardwood habitat, and establish hydrologic connectivity between the ARDC and western Maurepas Swamp. The project is estimated to create 679 Average Annual Habitat Units, promote germination and survival of bald cypress and other tree species, and improve biological productivity.

The enclosed comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.). Related correspondence should be directed to the

attention of Mr. Richard Hartman at the NMFS Southeast Region, Habitat Conservation Division office at: c/o LSU, Baton Rouge, Louisiana 70803-7535. He may be contacted by telephone at (225) 389-0508, ext. 203 or by e-mail at richard.hartman@noaa.gov.

Sincerely,

Miles M. Croom

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

cc:
FWS, Lafayette, Walther
EPA, Dallas, Ettinger
LA DNR, Consistency, Ducote
F/SER46, Swafford
F/SER4, Dale
NOAA PPI, Reid
Files

National Marine Fisheries Service Comments on the Draft Supplemental Environmental Impact Statement For the Louisiana Coastal Area (LCA) Amite River Diversion Canal (ARDC) Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study, Ascension and Livingston Parishes, Louisiana Authorized under the 2007 Water Resources Development Act

General comments

The information presented in the Supplemental Environmental Impact Statement (SEIS) supports the determination that the Tentatively Selected Plan (TSP) is environmentally acceptable and would promote the long-term recovery and health of one of Louisiana's largest tracts of freshwater swamp and a major ecological component of the Lake Pontchartrain basin. Best management practices, environmental monitoring, and adaptive management as needed to protect fish and wildlife resources are specified in the SEIS. These measures should be retained as essential project components.

Without long term protection of the restored bald cypress-tupelo swamp, the stated objectives and benefits of the TSP may not be attained. Although the SEIS frequently mentions conservation easements will be included in the TSP, there is no assurance the easements will be sufficient to preclude timber harvest and other environmental damage. The final SEIS should be modified to stress the importance of effective conservation easements and to indicate any benefits derived from the project would be eliminated if timber harvest were allowed to occur.

Specific comments

SECTION 2.0 NEED FOR AND OBJECTIVES OF ACTION
2.3 Problems, Needs, and Opportunities
2.3.4 Effects

Page 2-15, lines 486-490 This section should explain how biomass production of herbaceous plants has increased in a severely nutrient-limited environment. Also, the section should be revised to state that biomass production has increased based on data from nutrient monitoring stations rather than "by nutrient augmentation at monitoring stations."

Page 2-15, lines 520-525 The statement: "The existing levels of productivity in the western Maurepas Swamp are as low as 50 percent or even 25 percent of average values compared to swamps that are managed or have more favorable hydrology." is confusing and needs clarification.

Page 2-16, line 536 NMFS suggests changing "lost to mortality and disease" to "lost to disease and other causes". We presume that "lost" and "mortality" are the same.

Page 2-19, line 643 The basis for the statement: "It is a national priority to preserve and protect freshwater swamps" should be provided.

SECTION 4.0 AFFECTED ENVIRONMENT
4.2 Significant Resources
4.2.15 Socioeconomics and Human Resources

Page 4-65, lines 2222-2223 According to this section, a timber survey and appraisal was conducted in 1994 for 32,806 acres within the project area owned by Blind River Properties. Survey results revealed there were no areas of bald cypress and tupelo in the swamp with trees of sufficient size and volume to be considered merchantable. The final SEIS should be modified to identify whether and when the timber might be merchantable.

In all probability, timber value has increased over the past 16 years. Demand for smaller trees also may have increased based on current demand for cypress mulch. Based on these considerations and the 50-year project analysis period, the probability and consequences of timber harvest should be addressed in section 5.0 (Environmental Consequences) of the SEIS. Although noted in section 5.0 that little harvesting would take place based on planned conservation easements, the SEIS is unclear as to the extent to which easements would restrict timber harvest and which areas would be covered by such easements.

SECTION 5.0 ENVIRONMENTAL CONSEQUENCES

Page 5-11, Table 5.1 According to information contained in Table 5.1 (row 1, column 5; Future With Project Impacts), "little timber harvesting would take place in the future due to conservation easements." Although it is probable that a conservation easement would prohibit or severely restrict timber harvest, it is possible that limited or even complete removal of trees may occur, depending on the terms of the easement. As such, the table should be modified to note that timber harvest may be restricted depending upon the terms and conditions of the conservation easements and the areal extent of their jurisdiction. Alternatively, the terms of the conservation easements should be provided in the final SEIS and include language that clearly indicates that tree removal is prohibited.

5.15 Socioeconomic and human resources
5.15.12 Land Use Socioeconomics

Page 5-78, lines 2568-2571 According to this section, "conservation easements would be placed within the primary and secondary areas of impact for Alternative 33 (TSP), effectively restricting timber harvesting within portions of the study area over an indefinite period of time." As previously noted in our comments pertaining to Table 5.1, timber harvest may occur unless prohibited by terms and conditions of the conservation easements. Additionally, greater specificity in needed concerning the location and size of the "primary and secondary areas of impact." Although Figure 3.4 (page 3-37 of the SEIS), illustrates primary and secondary areas of impact for Alternative 33, it is unclear if this is, in fact, the area to be covered by conservation easements. To address these factors, the final SEIS should contain the terms and conditions of

any existing or planned conservation easements and should clearly describe, via narration and map, the areas that would be covered by such easements. Unless the planned bald cypress-tupelo forest can be restored and maintained over the life of the project, the desired objectives and predicted benefits may not be attained. This should be noted in the final SEIS.

Because of the importance of conservation easements with regard to protecting and restoring fish and wildlife habitat, the final SEIS should note that NMFS and other federal and state resource agencies will be, or have been, consulted during development of the terms and conditions and determination of the location and areal extent of the conservation easement(s).

Finally, the possibility that tree planting and project related extension of dry periods (to promote seed germination) could actually encourage timber harvest should be addressed in the final SEIS.

SECTION 8.0 CONCLUSIONS AND DETERMINATIONS

8.2 Recommended Plan

Page 8-1, line 43 NMFS recommends changing "Easements on 1,633 acres of land" to "Conservation easements on 1,633 acres of land." Also, as previously noted, the final SEIS should be clear concerning the location and size (acreage) of areas to be protected by conservation easements. In this regard, clarification is needed as to location of the 1,633 acre area mentioned.

Appendix D

404(b)(1) WATER QUALITY REPORT

SECTION 404(b)(1) EVALUATION

AMITE RIVER DIVERSION CANAL MODIFICATION PROJECT, LIVINGSTON AND ASCENSION PARISHES, LOUISIANA

I. INTRODUCTION

A. Purpose and General Description.

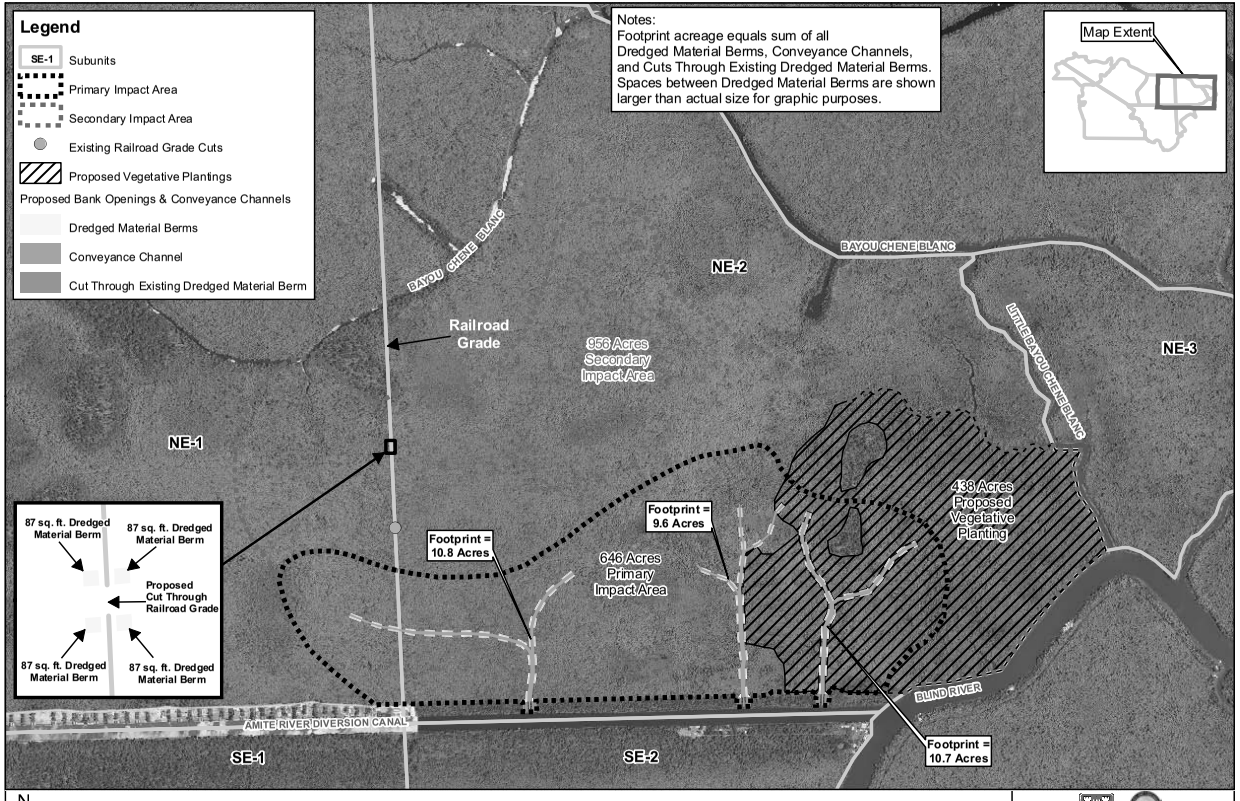
The placement of material dredged to construct the Amite River Diversion Canal (ARDC) adjacent to the canal created a hydrologic barrier that has isolated the swamps north and south of the ARDC. This has created standing water conditions that have led to degradation of the swamp habitats and prevented the introduction of nutrients that would promote the healthy growth and regeneration of plants.

The purpose of this project is to construct cuts in the dredged material banks on the north side of the ARDC to promote the exchange of water between the ARDC and the adjacent swamps. This action would allow periodic drying of the swamps, thereby enabling regeneration of trees. The action would enable the introduction of nutrients from the ARDC into the swamps, thereby promoting healthy growth of plants.

Features of the proposed action (Figure 1) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort



ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 1
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868

that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

B. Location.

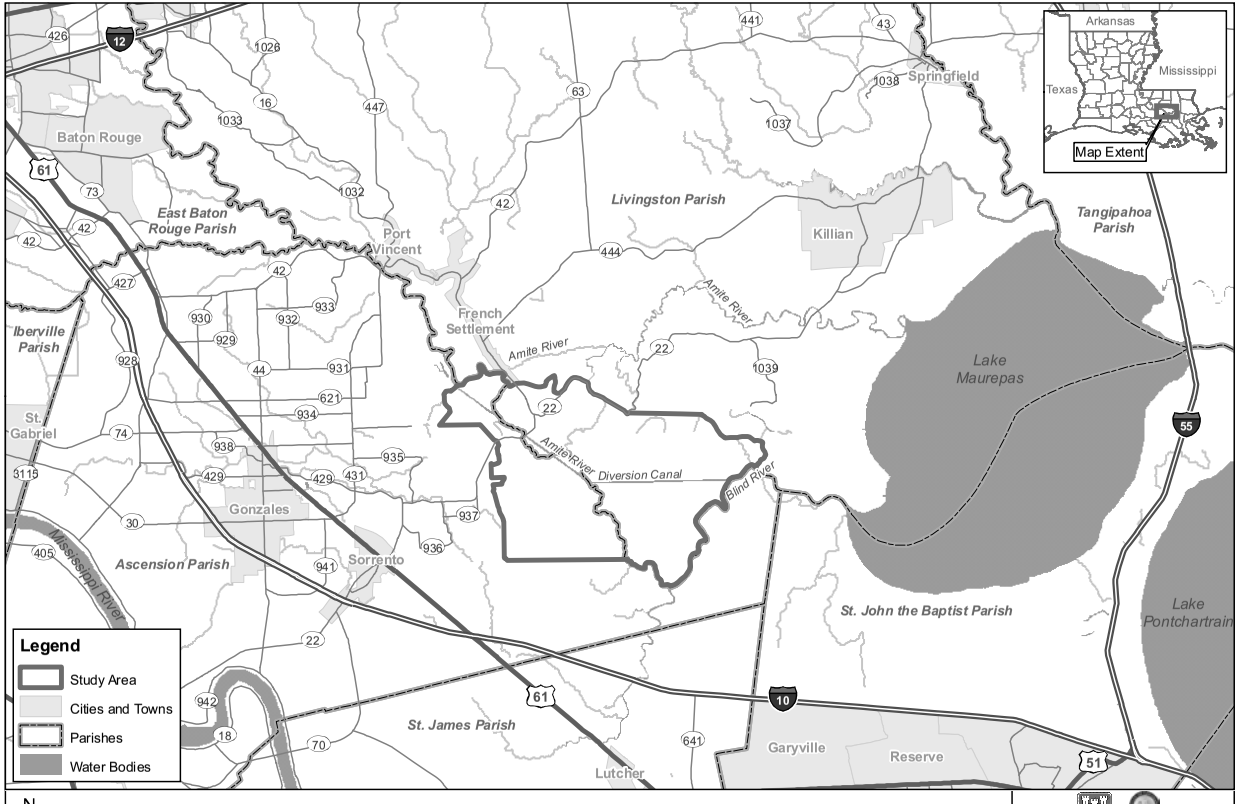
The Louisiana Coastal Area-Amite River Diversion Canal (LCA-ARDC) study area is located in LCA Subprovince 1 and is situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. A map of the study area is presented in Figure 2. The study area is bounded to the north by the old channel of the Amite River, Old River, and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Saveiro Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal; and is located in the following sections:

- Township 9 South, Range 4 East- Sections 9-16, 22-27, and 34-36;
- Township 9 South, Range 5 East- Sections 7, 14-36;
- Township 9 South, Range 6 East- Section 30;
- Township 10 South, Range 4 East- Sections 1-3 and 10-12; and
- Township 10 South, Range 5 East- Sections 2-11.

C. Authority.

Title VII of Water Resource Development Act (WRDA) 2007 authorizes the LCA program. The authority includes requirements for comprehensive coastal restoration planning, program governance, project modification investigations, a Science and Technology (S&T) program, restoration project construction, a program for beneficial use of dredged material, feasibility studies for restoration plan components, and other program elements.

In total, the LCA program has authority for 25 elements falling into various components including investigations, research, demonstrations, and construction. This report outlines the study elements requiring Congressional reporting that will be undertaken in partnership between the U.S. Army Corps of Engineers (USACE) and the State of Louisiana. Specifically, Section 7006(e)(3) requires the Secretary of the Army to submit feasibility reports to Congress on six



STUDY AREA REGION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 2
Date: October 2009
Scale: 1:260,000
Source: USDA/GEC
Map ID: 27850108-1781

elements by December 31, 2008 and one Chief's Report by December 31, 2010. The six elements are:

1) Multipurpose Operation of Houma Navigation Lock,
2) Terrebonne Basin Barrier Shoreline Restoration,
3) Small Diversion at Convent/Blind River,
4) Amite River Diversion Canal Modification,
5) Medium Diversion at White Ditch, and
6) Convey Atchafalaya River Water to Northern Terrebonne Marshes.

D. General Description of Dredged and Fill Material.

(1) General Characteristics of Material.

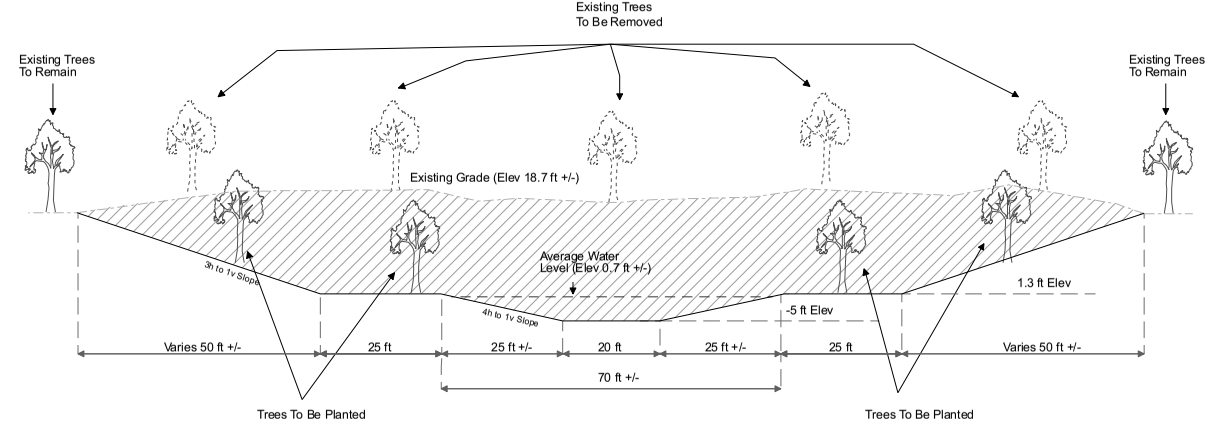
(a) Construction of Gaps in ARDC Dredged Material Banks (Figure 3). The material to be dredged for creating gaps in the ARDC dredged material bank is former swamp floor sediment that was previously dredged to construct the ARDC and placed adjacent to the channel. This material is primarily alluvial silt and clay that was deposited by annual flooding of the Mississippi and Amite Rivers along with varying amounts of organic matter.

Excavation of the gaps within the existing dredged material berms would be carried out by two amphibious, short-reach excavators a D-6 dozer, and a log skidder. As the equipment cuts its way into the gap locations, the dredged material removed would be placed on the swamp floor at the interface of the existing dredged material berm and the conveyance channels to create bottomland hardwood (BLH) "islands" that would serve as wildlife refugia during time of high water. A total of 5.0 acres of dredged material would be placed within the construction footprint for the proposed action. It is anticipated that it would be necessary to remove stumps that are encountered during the dredging of the gaps. Best management practices, such as silt fencing and hay bales would be utilized during the construction process to prevent the transport of sediments within the construction and placement areas.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, would be based on a design cross section (Figure 3). This cross section was developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining.

(b) Construction of Cuts in Railroad Grade (See Figure 1). Material dredged to create cuts in the railroad grade is former swamp floor material that was used to construct the railroad grade. This material is primarily alluvial silt and clay that was deposited by annual flooding of the Mississippi and Amite Rivers along with varying amounts of organic matter.

Excavation of the cuts within the railroad grade would be carried out by an amphibious short-reach, excavator. As the equipment cuts its way into the cut locations, the dredged material removed would be placed on the swamp floor adjacent to the railroad grade. Material excavated from the gaps in the railroad grade (approximately 0.02 acres) represents a small percentage of the total acres of dredged material and is accounted for in the total 5.0 acres of dredged material



Legend

- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Area

Typical 70 ft. Cross Section through ARDC Dredged Material Berm

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741

that would be placed within the construction footprint for the proposed action. It is anticipated that it would be necessary to remove stumps that are encountered during the dredging of the cuts. Best management practices, such as silt fencing and hay bales, would be utilized during the construction process to prevent the transport of sediments within the construction and placement areas.

(c) Construction of Conveyance Channels (Figure 4). Material dredged to create conveyance channels is sediment that would be removed from the floor of the swamp. This material is primarily alluvial silt and clay that was deposited by annual flooding of the Mississippi and Amite Rivers along with varying amounts of organic matter.

Excavation of the conveyance channels would be carried out by two short-reach, amphibious excavators. As the equipment cuts its way into the conveyance channel locations, the dredged material would be placed on the swamp floor along the sides of the proposed conveyance channels. The material will be placed in lengths of 300 feet with 50-foot gaps between the placement areas. Material excavated during the construction of the conveyance channels would be used to create BLH "islands" that would serve as wildlife refugia during time of high water. This 50-foot gaps in the spoil placement will be added to prevent the placement of this material from interrupting sheet flow throughout the areas of impact (See Figure 5). A total of 5.0 acres of dredged material would be placed within the construction footprint for the proposed action. It is anticipated that it would be necessary to remove stumps that are encountered during the dredging of the gaps. Best management practices, such as silt fencing and hay bales, would be utilized during the construction process to prevent the transport of sediments within the construction and placement areas.

All excavation of the conveyance channels through the swamp will be based on three design cross sections (Figures 4 through 6). These cross sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining.

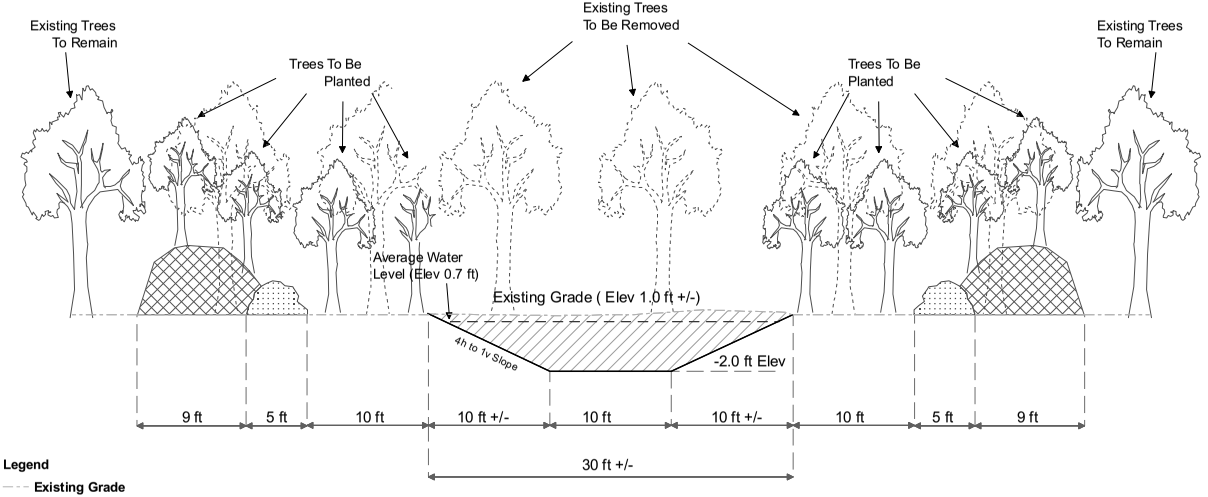
(d) Vegetative Plantings. Swamp vegetation, primarily bald cypress seedlings with accompanying nutria protection, would be planted on the swamp floor. Bottomland hardwood vegetation would be planted on BLH "islands" (See Figure 1.)

(2) Quantity of Material.

(a) Construction of Gaps in ARDC Dredged Material Banks. Approximately 13,753 cubic yards of material would be removed from the ARDC dredged material banks to construct cuts.

(b) Construction of Cuts in Railroad Grade. Approximately 60 cubic yards of material would be removed to construct cuts in the railroad grade.

(c) Construction of Conveyance Channels (Figure 7). Approximately 81,694 cubic yards of material would be removed from the swamp floor to construct conveyance channels.

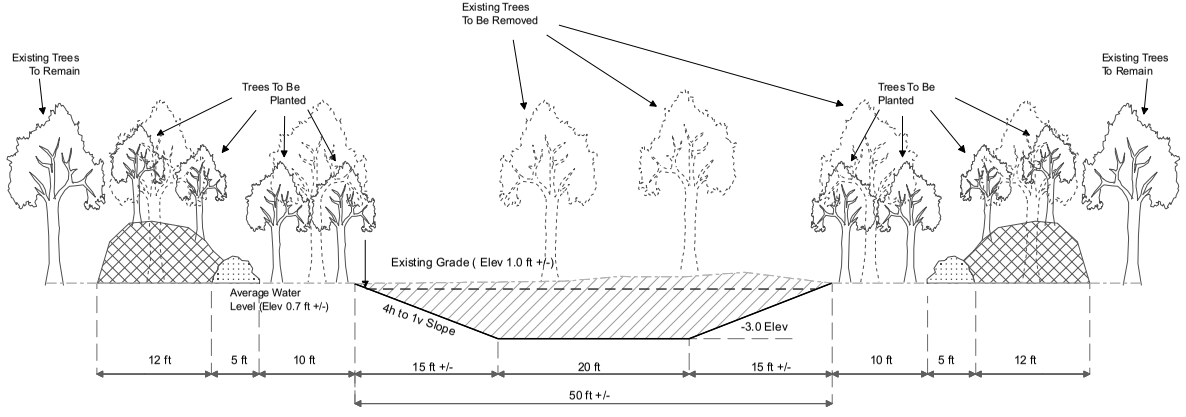


Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 30 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 4
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

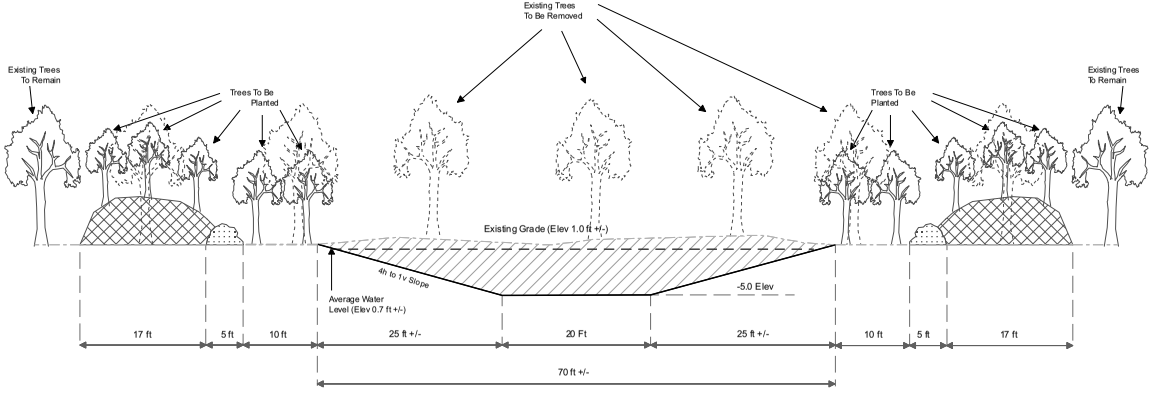
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 50 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 5
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

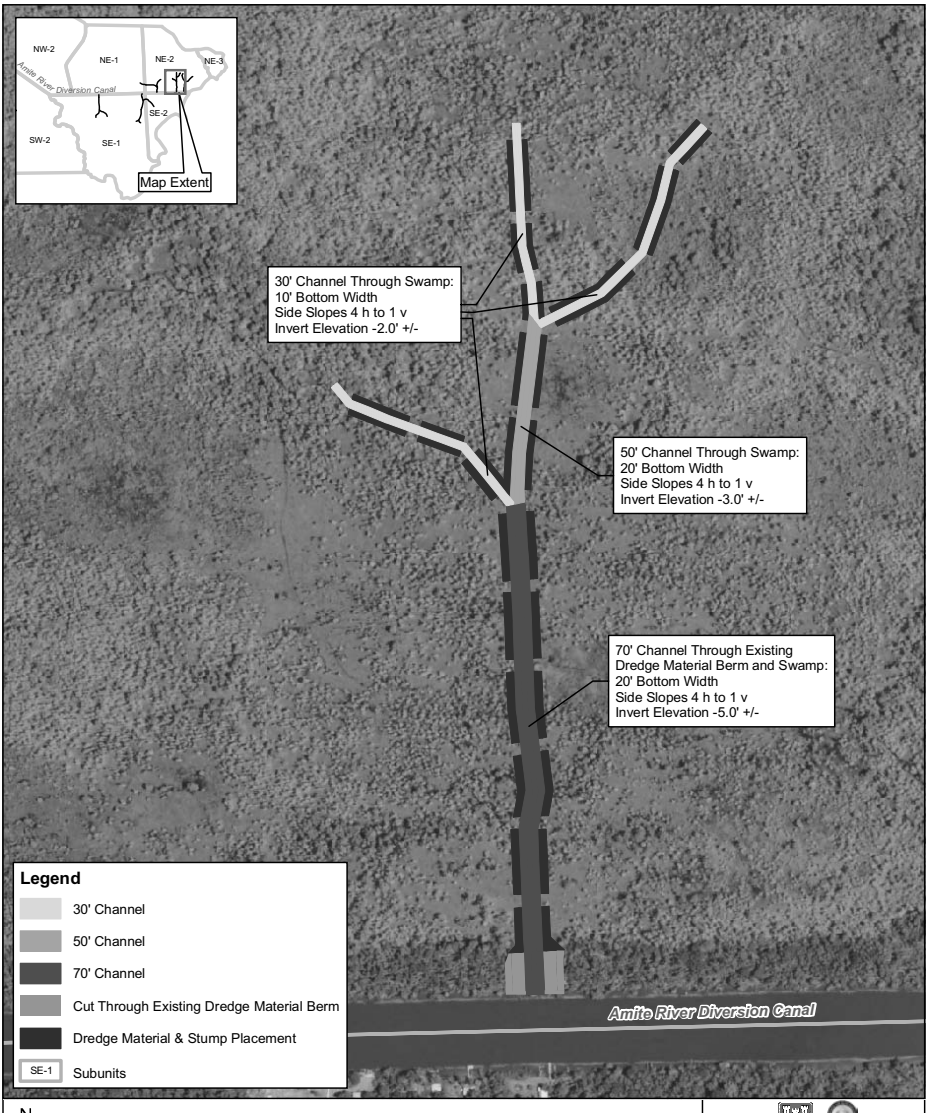
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 70 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 6
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



N

0 200 400 600 Feet

TYPICAL CONVEYANCE CHANNEL

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 7
Date: January 2010
Scale: 1:5,600
Source: USDA/GEC
Map ID: 27850108-1889

(d) Vegetative Plantings. Approximately 438 acres of swamp floor would be planted with swamp vegetation. BLH "islands" used as wildlife refugia, which would total approximately 5.0 acres, would be planted with bottomland hardwood forest species.

(3) Source of Material.

All material excavated and placed within the project area is present or former swamp floor native material deposited by historic and prehistoric annual flooding of the Mississippi and Amite Rivers. No material would be brought into the project area from outside sources.

Seedlings and 1 and 3-gallon potted plants for vegetative plantings would be purchased from commercial nurseries.

E. Description of the Proposed Discharge Sites.

(1) Location and Size.

(a) Construction of Gaps in ARDC Dredged Material Banks. Material excavated for the construction of gaps in the ARDC banks would be placed on the swamp flood at the interface of the existing dredged material berm and the conveyance channels to create BLH "islands" that would serve as wildlife refugia (see Figure 3).

(b) Construction of Cuts in Railroad Grade. Material excavated for the construction of cuts in the railroad grade would be placed on the swamp floor adjacent to the gaps in the railroad grade (see Figure 1).

(c) Construction of Conveyance Channels. Material excavated for the construction of conveyance channels would be placed at alternating locations adjacent to the channels to create BLH "islands" that would serve as wildlife refugia (see Figures 4 through 6).

(d) Vegetative Plantings. Vegetative plantings would be made on the swamp floor and on BLH "islands" that would serve as wildlife refugia (see Figure 1).

(2) Type of Site.

(a) Construction of Gaps in ARDC Dredged Material Banks. Material excavated for the construction of gaps in the ARDC banks would be placed within adjacent swamps to create BLH "islands" that would serve as wildlife refugia.

(b) Construction of Cuts in Railroad Grade. Material excavated for the construction of cuts in the railroad grade would be placed within adjacent swamps.

(c) Construction of Conveyance Channels. Material excavated for the construction of conveyance channels would be placed along the proposed channel to create BLH "islands" that would serve as wildlife refugia.

(d) Vegetative Plantings. Seedlings and potted plants would be planted on the existing swamp floor and on the material placed within the swamps to create BLH “islands” that would serve as wildlife refugia.

(3) Type of Habitat.

(a) Construction of Gaps in ARDC Dredged Material Banks. Material excavated for the construction of gaps in the banks on the northern side of the ARDC would be placed within adjacent degraded swamps. Placement sites would include severely degraded areas that are impounded for a majority of the year by the ARDC dredged material banks.

(b) Construction of Cuts in Railroad Grade. Material excavated for the construction of cuts in the railroad grade on the northern side of the ARDC would be placed within adjacent degraded swamps. Placement sites may include severely degraded areas that are impounded for a majority of the year by the ARDC dredged material banks.

(c) Construction of Conveyance Channels. All material dredged during construction of the conveyance channels would be placed along the channels to also create BLH habitat "islands." Placement sites may include severely degraded areas that are impounded for a majority of the year by the ARDC dredged material banks.

(d) Vegetative Plantings. Plantings located on the swamp floor on the northern side of the ARDC would be provided to promote the recovery of swamp degraded by inundation and a lack of hydrologic connectivity. With the establishment of hydrologic connectivity through the construction of gaps in the ARDC banks, the swamp is anticipated to regain sufficient health to allow vegetative plantings to survive and reestablish a forest canopy.

(4) Timing and Duration of Discharge.

It is estimated that total construction time, which would involve the excavation of gaps in the ARDC banks, excavation of gaps in the railroad grade, dredging of conveyance channels, placement of excavated and dredged materials to create BLH “islands” used for wildlife refugia, and plantings to revegetate the areas would take approximately six years.

F. Description of Disposal Method.

(a) Construction of Gaps in ARDC Dredged Material Banks. Excavation of the gaps within the existing dredged material berms would be carried out by a two short-reach, amphibious excavators.

(b) Construction of Cuts in Railroad Grade. Excavation of the gaps within the railroad grade would be carried out by a short-reach, amphibious excavator.

(c) Construction of Conveyance Channels. Excavation of conveyance channels would be carried out by a short-reach, amphibious excavator.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations.

(1) Comparison of Existing Substrate and Fill.

(a) Construction of Gaps in ARDC Dredged Material Banks. Material that would be excavated from the ARDC dredged material banks is former swamp substrate that was dredged to create the ARDC, which was completed in 1963. The proposed action would place this material back into the swamp. It is likely that the some of the physical characteristics of the excavated material differ to some degree from the swamp substrate on which it would be placed; the dredged material has likely consolidated and lost some of its original organic matter through oxidation. The inorganic components of the dredged material would be identical to the existing swamp substrate.

(b) Construction of Cuts in Railroad Grade. The railroad grade was constructed from adjacent swamp substrate. Material excavated to construct cuts in the railroad grade would be returned to the swamp substrate. The low elevation of the grade, which is less than one foot above the average water level of the swamp, has likely retained most of its original characteristics and is expected to be virtually identical to the existing swamp substrate.

(c) Construction of Conveyance Channels. Material excavated to construct conveyance channels is existing swamp substrate that would be placed on like material.

(2) Changes to Disposal Area Elevation.

(a) Construction of Gaps in ARDC Dredged Material Banks. Figure 3 shows a cross section of the construction for a typical gap in the ARDC bank; elevations are indicated. The removal of material from the ARDC bank would reduce the elevation to a minimum of approximately 5.5 feet below the average water level in the canal. Material removed to create the gaps would be placed on the swamp floor to create BLH “islands” that would provide refugia for wildlife during periods of high water in the swamp. The elevations of the BHL “islands” would be approximately 10 feet, before consolidation, and would change the habitat type from swamp to bottomland hardwood and upland forest.

(b) Construction of Cuts in Railroad Grade. The elevation of the railroad grade at the location of the cut would be reduced to a minimum of 1 foot below the average water level in the swamp. The material removed to construct the cut would be placed on the swamp floor, raising the elevation at the placement location to approximately two to four feet, which may change the habitat type at some locations to bottomland hardwood forest.

(c) Construction of Conveyance Channels. The construction of conveyance channels would reduce the elevation of the substrate to approximately 5.5 feet below the average water level of the swamp (Figures 4 through 6). Material removed to construct conveyance channels would be placed on the swamp floor, raising the elevation at those locations to approximately four feet, which would change the habitat type to bottomland hardwood forest.

(3) Migration of Fill.

Because of the low velocities of water flow across the swamp and the revegetation of areas where fill would be placed, it is anticipated that little or no migration of fill would occur.

(4) Duration and Extent of Substrate Change.

Material excavated for the construction of gaps in the ARDC banks, material excavated for the construction of cuts in the railroad grade, and material dredged for the construction of conveyance channels would be placed on the swamp floor in proximity to the construction area. Material removed would be placed on the swamp floor to create BLH "islands" that would provide refugia for wildlife during periods of high water in the swamp as recommended by representatives of the Louisiana Department of Wildlife and Fisheries. Figures 1, and 3 through 7, show the approximate locations of placement sites. It is intended that these sites would be permanent.

(5) Changes to Environmental Quality and Value.

Physical substrates would be altered by the excavation of material for the construction of gaps in the ARDC dredged material berms and the cuts in the railroad grade, as well as the dredging of conveyance channels. At these locations, existing elevations would be lowered. Material removed by excavation and dredging would be placed at locations on the swamp floor where the elevation would be raised to create BLH "islands" that would provide refugia for wildlife during periods of high water in the swamp. Although these actions would alter existing habitats, the overall effect of the proposed action would enhance the environmental quality of the study area.

(6) Actions to Minimize Impacts. It is anticipated that construction activities would involve the use short-reach, amphibious excavators, the use of which would result in fewer impacts to the physical substrate that alternative methods. Some clearing of vegetation would be necessary to provide access to the sites for construction activities, but revegetation of disturbed areas is included in the proposed action. Best management practices, such as silt fencing and hay bales, would be utilized during the construction process to prevent the transport of sediments within the construction and placement areas.

B. Water Circulation, Fluctuation, and Salinity Determinations.

(1) Alteration of Current Patterns and Water Circulation.

The proposed action is intended to reverse the effects of alterations in flow that were caused by the construction of the ARDC and deposition of dredged material along the banks thereby impeding the hydrologic connectivity needed for the maintenance of a healthy swamp. The construction of gaps in the banks and cuts in the railroad grade are intended to (1) remove the impoundments on the northern side of the ARDC and provide hydrologic connectivity between the swamp and the ARDC; (2) promote the introduction of flows from the ARDC to

swamps adjacent to the ARDC during periods of elevated water levels in the ARDC; (3) provide a degree of sheet flow by removing restrictions created by the railroad grade.

(2) Interference with Water Level Fluctuation.

The proposed action is intended to eliminate the impoundments created by the ARDC dredged material banks and provide the swamp with seasonal water level fluctuations necessary to maintain a healthy swamp.

(3) Salinity Gradient Alteration.

Salt water is currently being introduced into the swamp during storm tides, such as those experienced during tropical cyclone storm surges. Because of the lack of hydrologic connectivity, this salt water remains resident in the swamps for extended periods of time, which results in extensive mortality to swamp vegetation. The gaps in the ARDC banks and cuts in the railroad grade would provide a means for the salt water to be flushed from the swamp and reduce mortality through the resulting increase in hydrologic connectivity that would occur.

(4) Effects on Water Quality.

(a) Salinity. No effect.

(b) Clarity**.** Effects of the proposed action on water clarity would be most likely to occur during construction. Excavation associated with the construction of gaps, cuts and access channels would reduce water clarity, as would the placement of material excavated during construction. However, any reduction in clarity caused by construction activities would be short duration and clarity would return to pre-construction levels following the revegetation of banks and placement areas.

(c) Color**.** With the establishment of hydrologic connectivity between water from impounded areas within the swamp on would be able to drain from into the ARDC. Because of dissolved tannins and lignins originating from the decomposition of organic matter, swamp water may have a darker color than the water in the ARDC This color difference would be most noticeable in the immediate vicinity of the gaps in the ARDC bank. The colored water would not have any adverse effect on water quality. As mixing occurs in the ARDC, any noticeable color would be lost.

A similar occurrence of the introduction of colored swamp water may be seen during high flow conditions when water is introduced from the ARDC to swamps through gaps in the bank of the ARDC. Water flowing from swamps may be of a darker color than ambient water in Blind River.

(d) Water Chemistry and Dissolved Gasses**.** Materials excavated and dredged to provide features of the proposed action would contain variable concentrations of organic material. Decomposition of organic material within the placement sites may result in a local, temporary reduction in dissolved oxygen or release of ammonia. However, hydrologic exchange between

the swamps and the ARDC would reduce dissolved oxygen deficits and facilitate the transformation of ammonia into non-toxic nitrate. The introduction of swamp water into the ARDC may create low dissolved oxygen concentration near gaps in the banks, particularly during summer, but it is anticipated that any adverse effects would be localized.

(e) Temperature. No effect.

(f) Nutrients**.** An existing problem with the swamps along the ARDC is a lack of nutrients. One of the objectives of the proposed action is to allow waters in the ARDC to supply nutrients to the adjacent swamps. This would provide a slight decrease in the concentrations of nutrients in the ARDC.

(5) Changes to Environmental Quality and Value.

Construction activities may temporarily affect water quality by increasing turbidity/suspended solids in the swamps and the ARDC, but turbidity/suspended solid concentrations would return to preconstruction activities following completion of the project.

(6) Actions Taken to Minimize Impacts.

The primary adverse impacts on water circulation, fluctuation, and water quality are likely to be increased concentrations of turbidity/suspended solids in the swamps and the ARDC. Best management practices, such as silt fencing and hay bales would minimize impacts. Turbidity/suspended solid concentrations would return to preconstruction activities following completion of the project

C. Suspended Particulate/Turbidity Determinations.

(1) Alteration of Suspended Particulate Type and Concentration.

Material excavated from the ARDC banks and railroad grade and material dredged to construct conveyance channels is of similar physical and chemical quality to existing substrates within the swamps. Particulates suspended during project construction or by natural forces after project completion are not expected to differ in type from particulates currently within the project area. Construction operations are expected to temporarily increase the concentration of suspended particulates. Particulates suspended during project construction would dissipate after construction activities are complete.

(2) Particulate Plumes Associated with Discharge.

Temporary and localized particulate plumes may occur in the ARDC during construction activities but would quickly dissipate after construction is complete. The placement of excavated and dredged material within the swamp to create BLH “islands” that would provide wildlife refugia is expected to result in temporary occurrences of elevated turbidity. Turbidity levels would return to pre-construction levels following construction and revegetation of the sites.

(3) Changes to Environmental Quality and Value.

Particulate plumes resulting from any construction activity are not expected to persist after project completion. Particulates suspended by the deposition of excavated and dredged material at the placement during project construction or by natural forces after project completion are not expected to differ in type from particulates currently within the study area.

(4) Actions to Minimize Impacts.

Construction operations are expected to temporarily increase the concentration of suspended particulates. Particulates suspended during project construction would dissipate after construction activities are complete. Temporary increases in suspended particulates, which may form turbidity plumes in the ARDC and the swamp, may occur. This would be minimized by implementation of best management practices, such as silt fencing and hay bales, to prevent the transport of sediments within the construction and placement areas.

D. Contaminant Determinations.

Fill material is former swamp sediment that would be returned to the swamp floor. There are no indications that the material has contaminants. The nearest development is primarily residential, but the areas to be excavated are not in the immediate vicinity of development. A phase I environmental site assessment of the study revealed no potential sources of contamination at or near the construction areas.

E. Aquatic Ecosystem and Organisms Determinations.

(1) Effects on Plankton.

Because of the presence of a forest canopy and floating vegetation (primarily salvinia and water hyacinth), a plankton community within the swamps is unlikely to be a significant resource. Therefore the placement of material excavated to construct gaps in the ARDC banks, railroad cuts, or conveyance channels would have little, if any, effect on plankton.

However, it is likely that a plankton community is present in the ARDC. The excavation of the banks to construct gaps is likely to create sufficient turbidity in the vicinity of construction to adversely affect plankton during project construction. Other project activities, such as loading and unloading equipment, construction of staging areas, etc., may temporarily increase turbidity within the ARDC and may adversely impact plankton during operations.

(2) Effects on Benthos.

Benthic organisms would be smothered by the discharge of dredged material at material placement sites, where increased elevations would eliminate benthic habitats. Benthic organisms from adjacent areas would colonize substrates within conveyance channels and open water areas within constructed gaps and cuts. With the establishment of hydrologic connectivity between the

swamps and the ARDC, benthic populations in areas that are permanently impounded would be replaced by population characteristic of seasonally flooded swamps.

(3) Effects on Nekton.

Some species of the nekton community in the ARDC may be temporarily displaced during construction operations. Construction of gaps, cuts, and conveyance channels would provide an array of foraging, breeding, spawning, and cover habitat for a variety of adult and juvenile fishes. Reestablishment of hydrologic connectivity would enable the utilization of numerous microenvironments by juvenile fishes.

(4) Effects on the Aquatic Food Web.

The aquatic food web would benefit from both short and long-term changes resulting from the proposed action, including additions in energy to basal elements of the food web, habitat preservation, and increased habitat complexity. Nutrients and detritus provided by the enhancement of degraded swamp habitats would be added to the existing food web. The proposed action would reestablish numerous microenvironments that would be utilized by invertebrates and juvenile fishes that serve as prey items for larger fauna.

(5) Effects on Threatened and Endangered Species.

The West Indian manatee, listed as endangered in Ascension Parish, is the only species likely to occur in the study area. The West Indian manatee is generally found in shallow, slow-moving rivers, estuaries, saltwater bays, canals and coastal areas. According to an inventory of manatee sightings compiled by the Louisiana Sea Grant Program, manatees have been sighted in the Amite River north of Bayou Manchac, upstream from Port Vincent and near the ARDC; the Blind River; and in Lakes Maurepas and Pontchartrain. Precautionary measures would be necessary to avoid harming these animals during construction activities.

(6) Effects on Other Wildlife.

Representatives of the Louisiana Department of Wildlife and Fisheries have recommended that project features include the placement of excavated material on the swamp floor to create BLH “islands” that would serve as refugia for such wildlife as white-tailed deer during periods of high water levels within the swamp. These refugia have been incorporated into the proposed action. Therefore, the proposed action is expected to benefit terrestrial wildlife of the study area.

The bald eagle, although delisted, remains protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The bald eagle occurs in quiet coastal areas and along rivers or lakes near large tall trees. Eagles and eagle nests have been sighted in the western Maurepas Swamp, and at least one bald eagle nest is known to occur within the study area in the vicinity of NE-2. The conveyance channels were located to avoid potential impacts to the nest tree in accordance with the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

(7) Actions to Minimize Impacts.

Adverse impacts on benthic organisms are unavoidable. However, the loss of benthic habitat by the placement of excavated/dredged material on the swamp floor would be compensated by the improvement in water quality in the swamp. Additional benthic habitat would be provided by the construction of conveyance channels.

The plankton community of the ARDC may be affected by increased concentrations of turbidity/suspended solids during construction. Best management practices, such as silt fencing and hay bales, would minimize impacts. Turbidity/suspended solid concentrations would return to preconstruction activities following completion of the project.

Avoidance of activities in an area within 660 feet of the bald eagle nest, particularly during the nesting season, is expected to minimize disturbances.

F. Proposed Disposal Site Determinations.

Representatives of the State of Louisiana, Department of Wildlife and Fisheries have requested that material removed for the construction of gaps in the ARDC dredged material berms, cuts in the railroad grade, and conveyance channels be used to create BLH "islands" that could serve as resting areas and refugia for wildlife during periods when the swamp is flooded. These placement sites would be in proximity to the areas from which the material is removed, and the excavated/dredged material would be similar in nature to the substrate onto which it would be placed.

The placement areas would convert 5.0 acres of swamp habitat to bottomland hardwood forest habitat and upland habitat. However, the benefits of providing refugia for wildlife would outweigh the loss of wetlands, especially when the overall benefits of the proposed action would enhance the quality of 1,602 acres of forested wetlands.

G. Determination of Cumulative Effects on the Aquatic Ecosystem.

The proposed project would improve the quality of 1,602 acres of forested wetlands. Within these 1,633 acres, 438 acres of swamp vegetation would be replanted to restore the quality of degraded swamps. Wetland Value Assessments determined that 679 Average Annual Habitat Units (AAHUs) would be gained by the proposed action.

The proposed project would restore productive swamp habitat, while restoring hydrologic connectivity between the swamps and adjoining water bodies. Therefore, the incremental effect of the proposed action, when combined with past, present, and reasonably foreseeable future projects, would be of a beneficial nature, thereby lessening the overall cumulative impacts of projects and actions within the study area.

H. Determination of Secondary Effects on the Aquatic Ecosystem.

No secondary effects, other than the effects discussed in previous sections (some of which may be considered secondary), are expected.

III. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. No practicable alternatives to the proposed discharges could be identified that would have less adverse impacts on the aquatic ecosystem.

C. Chemical constituents of the dredged material released during dredging and disposal operations are not expected to exceed LA Water Quality Standards.

D. The proposed action is compliant with the Endangered Species Act of 1973, as amended. The proposed action would not significantly affect endangered or threatened species or their critical habitats.

E. The proposed action is compliant with specified protection measures for marine sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972. All disposal sites and effects are in inland waters. No effects would occur in ocean waters beyond the shoreline of the Gulf of Mexico.

F. Evaluation of Extent of Degradation of the Waters of the United States.

(1) Effects on Human Health and Welfare

(a) Municipal and Private Water Supplies. No effect on water supplies is expected.

(b) Recreational and Commercial Fisheries. No adverse effects on recreational and commercial fisheries are expected.

(c) Plankton. Plankton are expected to decrease in the immediate area of project construction operations due to increased turbidity. Adverse effects may linger for a period of time afterwards but would diminish as water clarity returns to preconstruction levels.

(d) Fish. No adverse effects on fish populations are expected.

(e) Wildlife. The proposed action would create BLH “islands” that would serve as refugia during periods of high water in the swamp. The effect of the proposed action would be beneficial.

(f) Special Aquatic Sites. No special aquatic sites would be adversely impacted.

(2) Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems.

The proposed action is expected to enhance and preserve degraded swamp habitats that provide an array of foraging, breeding, spawning, and cover habitat for a variety of adult and juvenile fishes, birds, mammals, and reptiles. The proposed action would restore numerous microenvironments that would be utilized as cover for juvenile fishes and invertebrates.

(3) Effects on Aquatic Ecosystem Diversity, Productivity and Stability.

The proposed action would enhance areas of degraded swamp, thereby enhancing and preserving diversity, productivity, and stability of the study area.

(4) Effects on Recreational, Aesthetic, and Economic Resources.

The proposed action would enhance areas of degraded swamp, thereby preserving areas that contribute to recreational, aesthetic, and economic benefits.

G. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem.

Construction equipment that would be used in swamps would be amphibious, short-reach excavators, which would create a lower impact on the swamp substrate than other methods such as board roads and conventional construction equipment. Standard best management practices would be implemented to minimize the erosion of exposed soil and the introduction of suspended solids into swamps and the ARDC. Revegetation of disturbed areas and material placement areas is a component of the proposed action. Any impacts on the aquatic ecosystem are expected to be minor and of short term. The intent of the project is to restore and maintain a high quality aquatic ecosystem.

IV. EVALUATION RESPONSIBILITY

Evaluation Prepared By:

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Evaluation Reviewed By:

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The proposed plan for the ARDC Modification Ecosystem Restoration Project, which incorporates sites for dredging and excavation and the placement of fill, complies with the requirement of guidelines, and includes appropriate and practicable methods to minimize adverse effects to the aquatic ecosystem.

Date: Sept 27, 2010

Joan M Exnicios

Joan M. Exnicios, Chief
Environmental Planning and Compliance Branch

Planning, Programs, and
Project Management Division
Environmental Planning
and Compliance Branch

PUBLIC NOTICE

**LOUISIANA COASTAL AREA - ECOSYSTEM RESTORATION PROJECT
AMITE RIVER DIVERSION CANAL MODIFICATION PROJECT,
LIVINGSTON AND ASCENSION PARISHES, LOUISIANA**

Introduction. This Public Notice is issued in accordance with provisions of Title 33 CFR Parts 336.1(b)(1) and 337.1, which establish policy, practices, and procedures to be followed on federal actions involving the disposal of dredged or fill material into waters of the United States.

Project Authority. The authority for the proposed action is Title VII of the Water Resources Development Act (WRDA) 2007 authorizes the Louisiana Coastal Area (LCA) ecosystem restoration program.

Location. The proposed action is located in Livingston and Ascension Parishs, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Saveiro Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal.

Project Description. The USACE proposes to dredge openings in the existing Amite River Diversion Canal (ARDC) spoil banks, construct bifurcated conveyance channels, and establish vegetative plantings in the study area. Without action, approximately 18,204 acres of impounded swamp habitat would continue converting from a freshwater swamp to fragmented freshwater marsh and open water habitats. Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced. *The proposed action itself consists of measures to minimize the adverse effects of storm water erosion and thus requires no separate measures or controls for compliance with CWA Section 402(p) and LAC 33:IX.2341.B.14.j.*

Discharges by Others.

Other Information. A Draft Environmental Impact Statement (DEIS), entitled Integrated Louisiana Coastal Area - Ecosystem Restoration Project Feasibility Study and Supplemental Environmental Impact Statement for Amite River Diversion Canal Modification Project, Livingston and Ascension Parishes, Louisiana, was mailed to the public for a 45-day review on May 21, 2010. The DEIS addressed the impacts associated with the construction of a proposed dredge openings in the existing Amite River Diversion Canal (ARDC) spoil banks, construct bifurcated conveyance channels.

Properties Adjacent to Disposal Sites. The proposed action is adjacent to Amite River Diversion Canal.

Status of EIS and Other Environmental Documents. Environmental compliance for the proposed action would be achieved upon: coordination of the EIS and supporting documents with appropriate agencies, organizations, and individuals for their review and comments; U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) confirmation that the proposed action would not be likely to adversely affect any endangered or threatened species; Louisiana Department of Natural Resources concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the Louisiana Coastal Resources Program; receipt of a Water Quality Certificate from the State of Louisiana; public review of the Section 404(b)(1) Public Notice; signature of the Section 404(b)(1) Evaluation; receipt of the Louisiana State Historic Preservation Officer Determination of No Affect on cultural resources; receipt and acceptance or resolution of all USFWS Fish and Wildlife Coordination Act recommendations; receipt and acceptance or resolution of all Louisiana Department of Environmental Quality comments on the air quality impact analysis documented in the EA; and receipt and acceptance or resolution of all NMFS Essential Fish Habitat recommendations. The draft ROD would not be signed until the proposed action achieves environmental compliance with applicable laws and regulations, as described above.

Coordination. The following is a partial list of agencies to which a copy of this notice is being sent:

U.S. Environmental Protection Agency, Region VI
U.S. Fish and Wildlife Service
National Marine Fisheries Service
U.S. Coast Guard, Eighth District
Louisiana Department of Environmental Quality
Louisiana Department of Natural Resources
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Transportation and Development
Louisiana State Historic Preservation Officer

This notice is being distributed to these and other appropriate Congressional, federal, state, and local interests, environmental organizations, and other interested parties.

Evaluation Factors. Evaluation includes application of the Section 404(b)(1) guidelines promulgated by the Administrator of the U.S. Environmental Protection Agency, through 40 CFR 230.

Public Involvement. Interested parties may express their views on the disposal of material associated with the proposed action or suggest modifications. All comments postmarked on or before the expiration of the comment period for this notice will be considered.

Any person who has an interest that may be affected by deposition of excavated or dredged material may request a public hearing. The request must be submitted in writing to the District Engineer within the comment period of this notice and must clearly set forth the interest that may be affected and the manner in which the interest may be affected by the proposed action.

You are requested to communicate the information contained in this notice to any parties who may have an interest in the proposed action.

For further information regarding the proposed action, please contact Dr. Klein at (504) 862-2540. Dr. Klein's FAX number is (504) 862-2572 and his E-mail address is William .P.Klein@usace.army.mil.

Joan M. Exnicios
Chief, Environmental Planning
and Compliance Branch

COMMENT PERIOD FOR THIS PUBLIC NOTICE EXPIRES: June 21, 2010

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

OMB APPROVAL NO. 0710-003
Expires October 1996

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	***2. FIELD OFFICE CODE***	***3. DATE RECEIVED***	***4. DATE APPLICATION COMPLETED***

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME U.S. Army Corps of Engineers, New Orleans District	***8. AUTHORIZED AGENT'S NAME AND TITLE*** *(an agent is not required)* Not Applicable
6. APPLICANT'S ADDRESS CEMVN P.O. Box 60267 New Orleans, LA 70160-0267	***9. AGENT'S ADDRESS*** Not Applicable
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence : b. Business : (225) 862-1958	***10. AGENT'S PHONE NOS. W/AREA CODE*** a. Residence : Not Applicable b. Business : Not Applicable

11. STATEMENT OF AUTHORIZATION

APPLICANT'S SIGNATURE _____ *DATE* _____

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Louisiana Coastal Area-Amite River Diversion Canal Modification Project

13. NAME OF WATER BODY, IF KNOWN *(if applicable)* Amite River Diversion Canal	***14. PROJECT STREET ADDRESS*** *(if applicable)* Not Applicable
15. LOCATION OF PROJECT Livingston and Ascension (***PARISH***) LA (***STATE***)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN *(see instructions)*

17. DIRECTIONS TO THE SITE

The project site extends along the Amite River Diversion Canal between the Petite Amite River and Blind River.

18. Nature of Activity *(Description of project, include all features)*

Features of the proposed action (**Figure 1**) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

19. Project Purpose *(Describe the reason or purpose of the project, see Instructions)*

The purpose of this project is to construct cuts in the dredged material banks on the north side of the Amite River Diversion Canal to promote the exchange of water between the Diversion Canal and the swamps. This action would allow periodic drying of the swamps, thereby enabling regeneration of trees. The action would enable the introduction of nutrients from the Amite River Diversion Canal into the swamps, thereby promoting healthy growth of plants. Excavated and dredged material will be used to create elevated areas that would provide refuges for wildlife during periods of high water in the swamp.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

The placement of material dredged to construct the Amite River Diversion Canal along the banks created a hydrologic barrier that has isolated the swamps north and south of the Amite River Diversion Canal. This has created standing water conditions that have led to degradation of the swamp habitats and prevented the introduction of nutrients that would promote the healthy growth and regeneration of plants. The degraded swamps are in the process of transitioning to freshwater marshes and open water. Without the proposed action, this transition will continue.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

The material to be excavated and dredged is former swamp floor sediment. This material is primarily alluvial silt and clay that was deposited by annual flooding of the Mississippi and Amite Rivers along with varying amounts of organic matter. It is anticipated that it would be necessary to remove stumps that are encountered during the dredging of the gaps. The amount of material is estimated to be 95,447cubic yards.

Approximately 438 acres would be planted with vegetation. Swamp vegetation, primary baldcypress seedlings with accompanying nutria protection would be planted on the swamp floor. Bottomland hardwood vegetation would be planted on material placement sites.

22. Surface Area in Acres of Wetlands or Other Waters Filled *(see instructions)*

Elevated placement areas would total approximately 5.0 acres and would be planted with bottomland hardwood forest species.

23. Is Any Portion of the Work Already Complete? Yes ___ No_X_ IF YES, DESCRIBE THE COMPLETED WORK

24. ***Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Water body (if more than can be entered here, please attach a supplemental list).***

25. ***List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.***

AGENCY	*TYPE APPROVAL**	*IDENTIFICATION NUMBER*	*DATE APPLIED*	*DATE APPROVED*	*DATE DENIED*
LDEQ	Water Quality Certification		TBD		

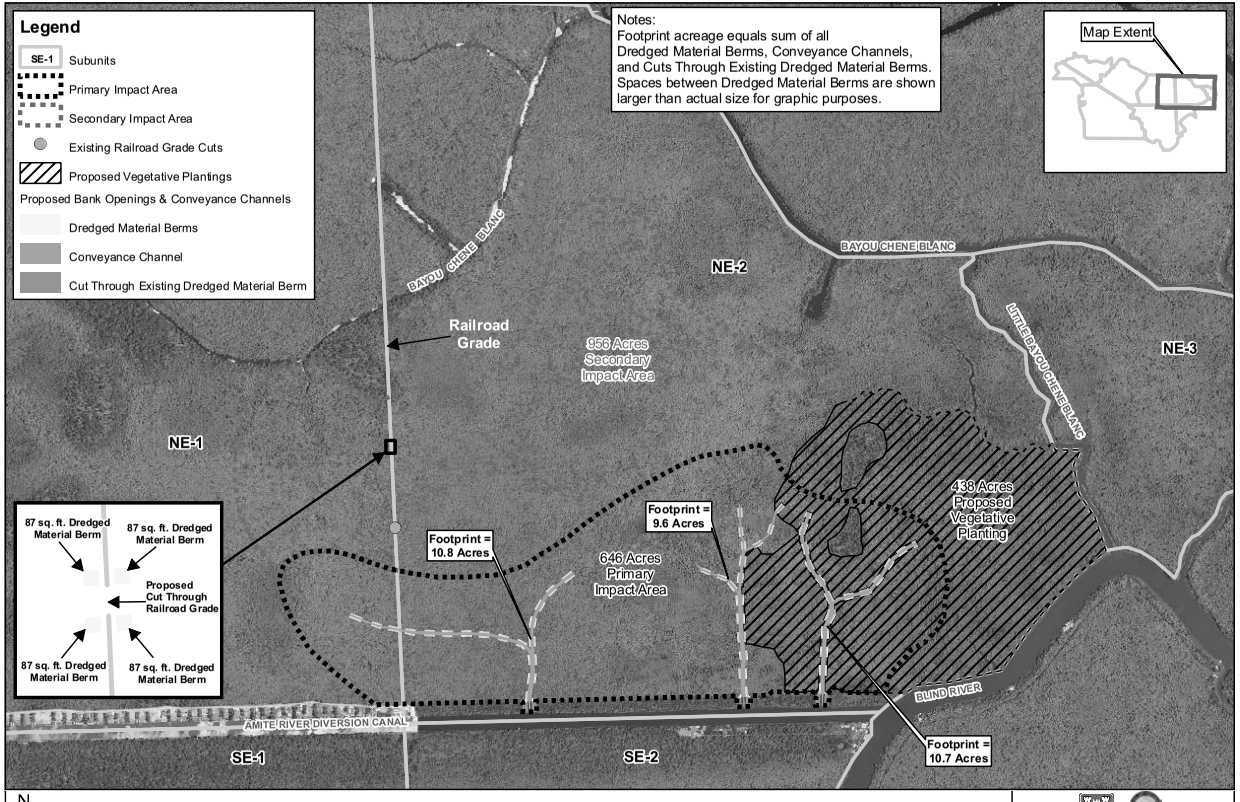
To the best of my knowledge the proposed activity described in my permit application complies with and will be conducted in a manner that is consistent with the LA Coastal Management Program.
** Would include but is not restricted to zoning, building and flood plain permits.*

26. ***Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.***

Sandra Stiles — *SIGNATURE OF APPLICANT*
Sept 27 2010 — *DATE*
Joan M Exnicios — *SIGNATURE OF AGENT*
Sept 27, 2010 — *DATE*

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department of agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more that $10,000 or imprisoned not more than five years or both.



ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 1
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

May 21, 2010

Planning, Programs, and
Project Management Division
Environmental Planning
and Compliance Branch

Melvin C. Mitchell, Sr.
Louisiana Dept. of Env. Quality
Water Quality Certifications Section
P.O. Box 4313
Baton Rouge, LA 70821-4313

Dear Mr. Mitchell, Sr.:

An application for a State Water Quality Certificate, prepared by the U.S. Army Corps of Engineers, New Orleans District (MVN) is enclosed. MVN staff request that a water quality certification be completed, pursuant to Section 401 of the Clean Water Act of 1977, as amended (33 U.S.C., Section 1341). The draft environmental impact statement (EIS) for the LCA Amite River Diversion Canal Modification, Louisiana, project is enclosed for your review and comment.

The 2004 Louisiana Coastal Area (LCA) Report identified critical projects, multiple programmatic authorizations, and ten additional required feasibility studies for the LCA. When the Water Resources Development Act of 2007 was passed, it included authorization under Title VII, for the LCA Program and specific authorization for feasibility reports on six of the ten near-term elements.

Two elements were determined to be hydrologically intertwined and the planning efforts were combined into Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock EIS Lafourche, Terrebonne, St. Mary Parish, Louisiana. The Terrebonne Basin Barrier Shoreline Restoration Study EIS (Volume V) is being completed under a separate feasibility effort due to a need for additional alternatives analysis and increasing uncertainties resulting from the Deepwater Horizon oil spill off the Louisiana coast. Consequently, only four of the Draft EIS and a Summary Document (Volume I) are available for public review at this time:

Amite River Diversion Canal Modification EIS (Volume II)
Convey Atchafalaya River Water to Northern Terrebonne Marsh /
Multipurpose Operation of the Houma Navigation Lock EIS (Volume III)
Small Diversion at Convent / Blind River EIS (Volume IV)
Medium Diversion at White Ditch EIS (Volume VI)

Enclosed with this letter are Volumes I and II. A copy of the other draft EIS are available upon request.

The USACE proposes to dredge openings in the existing Amite River Diversion Canal (ARDC) spoil banks, construct bifurcated conveyance channels, and establish vegetative plantings in the study area. Without action, approximately 18,204 acres of impounded swamp habitat would continue converting from a freshwater swamp to fragmented freshwater marsh and open water habitats. Excluding the No-Action Alternative, the final array of alternatives included seven options. Alternative 33 was chosen as the Tentatively Selected Plan (TSP). The TSP, at a total estimated construction cost of $7,770,000, would restore approximately 1,602 acres of swamp habitat, create 679 Average Annual Habitat Units (AAHUs), 5.0 acres of bottomland hardwood habitat, establish hydrologic connectivity, promote the germination and survival of the seedlings of bald cypress and other trees, and improve biological productivity.

To the best of our knowledge any dredge/fill material will be free of contaminants. Please provide the public notice for publication in the Advocate of Baton Rouge to the person listed below, as soon as possible. In addition to sending us a hard copy of the public notice documents, we request that you send a complete electronic copy via E-Mail to william.p.klein.Jr@usace.army.mil.

Please review the enclosed documents and provide comments within 45 days of the date stamped on the cover page of the EIS. Comments should be mailed to the attention of Dr. William Klein Jr.; U.S. Army Corps of Engineers; Planning, Programs, and Project Management Division; Environmental Planning and Compliance Branch; CEMVN-PM-RS; P.O. Box 60267; New Orleans, Louisiana 70160-0267.

Comments may also be provided by E-Mail to william.p.klein.Jr@usace. army.mil, or by fax to (504) 862-2088. Dr. Klein may be contacted at (504) 862-2540, if questions arise.

Sincerely,



for Joan M. Exnicios
Chief, Environmental Planning
and Compliance Branch

Enclosures

BOBBY JINDAL
GOVERNOR

PEGGY M. HATCH
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

SEP 20 2010

U.S. Army Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267

Attention: Sandra Stiles

RE: Water Quality Certification (WQC 100824-02/AI 171484/CER 20100002)
Louisiana Coastal Area- Amite River Diversion Canal Modification
Ascension & Livingston Parishes

Dear Ms. Stiles:

The Louisiana Department of Environmental Quality (the Department) has reviewed your application to improve hydrology along the Amite River Diversion Canal, in the vicinity of Head of Island, Louisiana.

Based on the information provided in the application, the Department made a determination that the requirements for a Water Quality Certification have been met and concludes that the placement of the fill material will not violate water quality standards of Louisiana as provided for in LAC 33:IX.Chapter 11. Therefore, the Department hereby issues a Water Quality Certification to the U.S. Army Corps of Engineers- New Orleans District.

Sincerely,

Melvin C. Mitchell, Sr.
Administrator
Water Permits Division

MCM/jjp

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Appendix E

LOUISIANA COASTAL RESOURCES PROGRAM CONSISTENCY DETERMINATION

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LOUISIANA COASTAL RESOURCES PROGRAM
CONSISTENCY DETERMINATION

AMITE RIVER DIVERSION CANAL MODIFICATION PROJECT,
LIVINGSTON AND ASCENSION PARISHES, LOUISIANA

1.0 INTRODUCTION

Section 307 of the Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et. seq. requires that "each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs." In accordance with Section 307, the U.S. Army Corps of Engineers (USACE), New Orleans District has prepared a Consistency Determination for the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project. Coastal Use Guidelines were written in order to implement the policies and goals of the Louisiana Coastal Resources Program, and serve as a set of performance standards for evaluating projects. Compliance with the Louisiana Coastal Resources Program, and therefore, Section 307, requires compliance with applicable Coastal Use Guidelines.

2.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the LCA Study is to:

- *Identify the most critical human and natural ecological needs of the coastal area;*
- *Present and evaluate conceptual alternatives for meeting the most critical needs;*
- *Identify the kinds of restoration features that could be implemented in the near-term (within 5 to 10 years) that address the most critical needs, and propose to address those needs though features that provide the highest return in net benefits per dollar of cost;*
- *Establish priorities among the identified near-term restoration features;*
- *Describe a process by which the identified priority near-term restoration features could be developed, approved, and implemented;*
- *Identify the key scientific uncertainties and engineering challenges facing the effort to protect and restore the ecosystem, and propose a strategy for resolving them;*
- *Identify, assess and, if appropriate, recommend feasibility studies that could be undertaken within the next 5 to 10 years to fully explore other potentially promising large-scale restoration concepts; and*

- *Present a strategy for addressing the long-term needs of coastal Louisiana restoration beyond the near-term focus of the Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan).*

Within the framework of the LCA Plan, the purpose of the proposed action is to address the problems of altered hydrology, swamp impoundment, decreased freshwater, sediment and nutrient input from the Amite River, decreased productivity, subsidence, impaired water quality, increased seedling mortality, and wetland degradation and loss within the study area. The USACE proposes to protect and restore, to the maximum extent practicable, the bald cypress-tupelo swamp within the study area. The LCA ARDC Modification project addresses systematic restoration of bald cypress-tupelo swamp in areas affected by the ARDC, and includes measures designed to prevent future bald cypress-tupelo swamp degradation and conversion, restore sheet flow impaired by dredged material bank construction, and protect vital socioeconomic and public resources.

The construction of the ARDC and the placement of dredged material along the banks to form continuous berms resulted in the impoundment, channelization, surge-related saltwater intrusion, and loss of freshwater, sediments, and nutrients from Amite River overbank flows. These alterations have all caused significant adverse impacts to the study area, resulting in poor swamp health and ecosystem degradation in the western Maurepas Swamp.

Prior studies and reports have documented degradation in the swamp adjacent to the ARDC and have demonstrated a need for ecosystem restoration that simulates historical hydrologic conditions. Without intervention, these problems would progressively get worse, until a significant portion of the bald cypress-tupelo swamp habitat within the study area is converted, initially to fresh marsh, and ultimately to shallow open water habitat.

This project is needed to establish hydrologic connectivity between the ARDC and adjacent swamp habitat to allow floodwaters to introduce additional nutrients and sediment into western Maurepas Swamp. The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the fresh water would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. Establishment of hydrologic connectivity is needed to allow swamps to drain during seasonal low-flow events, which would promote seedling germination and survival. Finally, establishment of hydrologic connectivity is needed to prevent the swamp habitat from converting to fresh marsh or open water.

As part of the goal of the LCA Plan, the goal of which is to reverse the current trend of degradation of the coastal ecosystem, the goal of the LCA ARDC Modification

project is to reverse the trend of degradation within the western Maurepas Swamp ecosystem that has been adversely affected by the construction of the ARDC. The LCA ARDC Modification project would contribute toward achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

The objectives of the LCA ARDC Modification project, with respect to the study area, include:

- Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.

- Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.

- Facilitate natural hydrologic cycle within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.

- Restore fish and wildlife habitat within the study area over the 50-year period of analysis.

This project would complement two other LCA projects: LCA Small Diversion at Hope Canal Diversion and LCA Small Diversion at Convent/Blind River Diversion, and two proposed Coastal Impact Assistance Program (CIAP) projects: CIAP Hydrologic Restoration in Swamps West of Lake Maurepas and CIAP Bald Cypress/Tupelo Coastal Forest Protection.

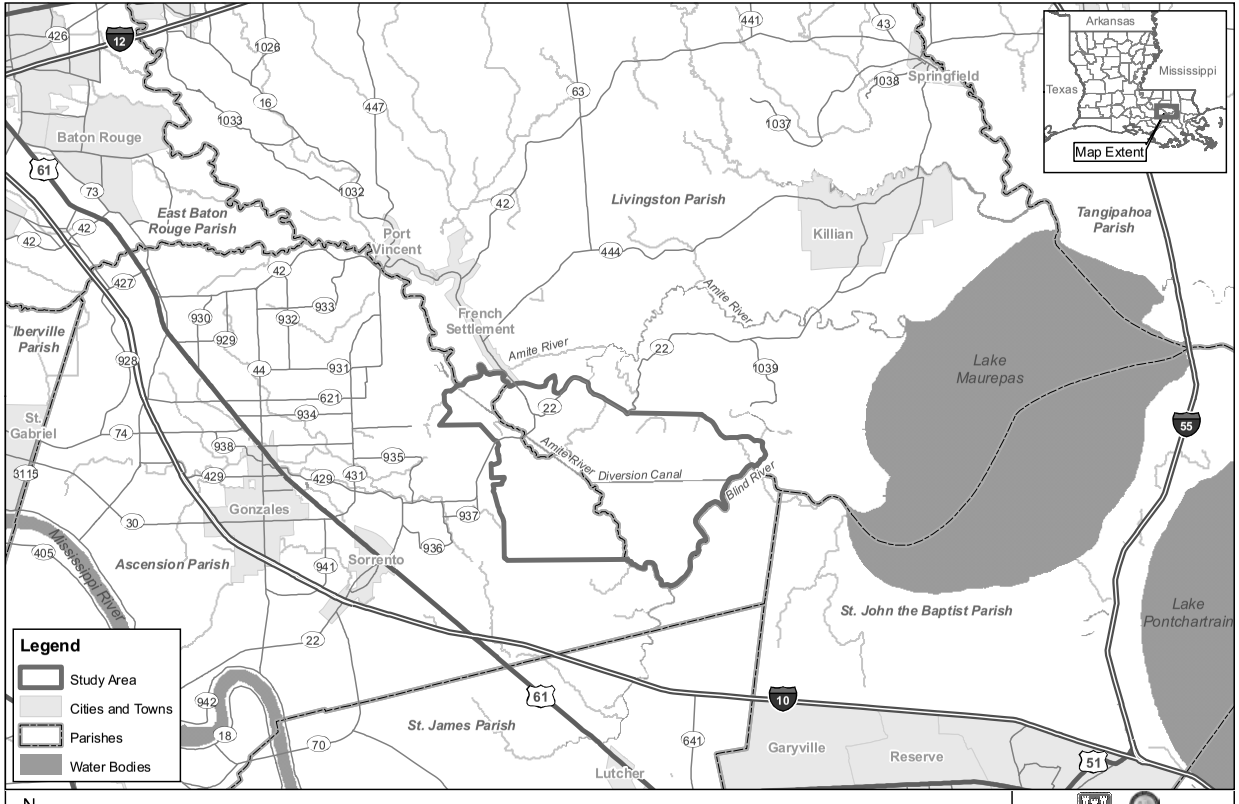
3.0 LOCATION AND GENERAL DESCRIPTION OF THE STUDY AREA

The LCA ARDC study area (Figures 1 and 2) is situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal; and is located in the following sections:

- Township 9 South, Range 4 East, Sections 9-16, 22-27, and 34-36;
- Township 9 South, Range 5 East, Sections 7, 14-36;

- Township 9 South, Range 6 East, Section 30;
- Township 10 South, Range 4 East, Sections 1-3 and 10-12; and
- Township 10 South, Range 5 East, Sections 2-11.

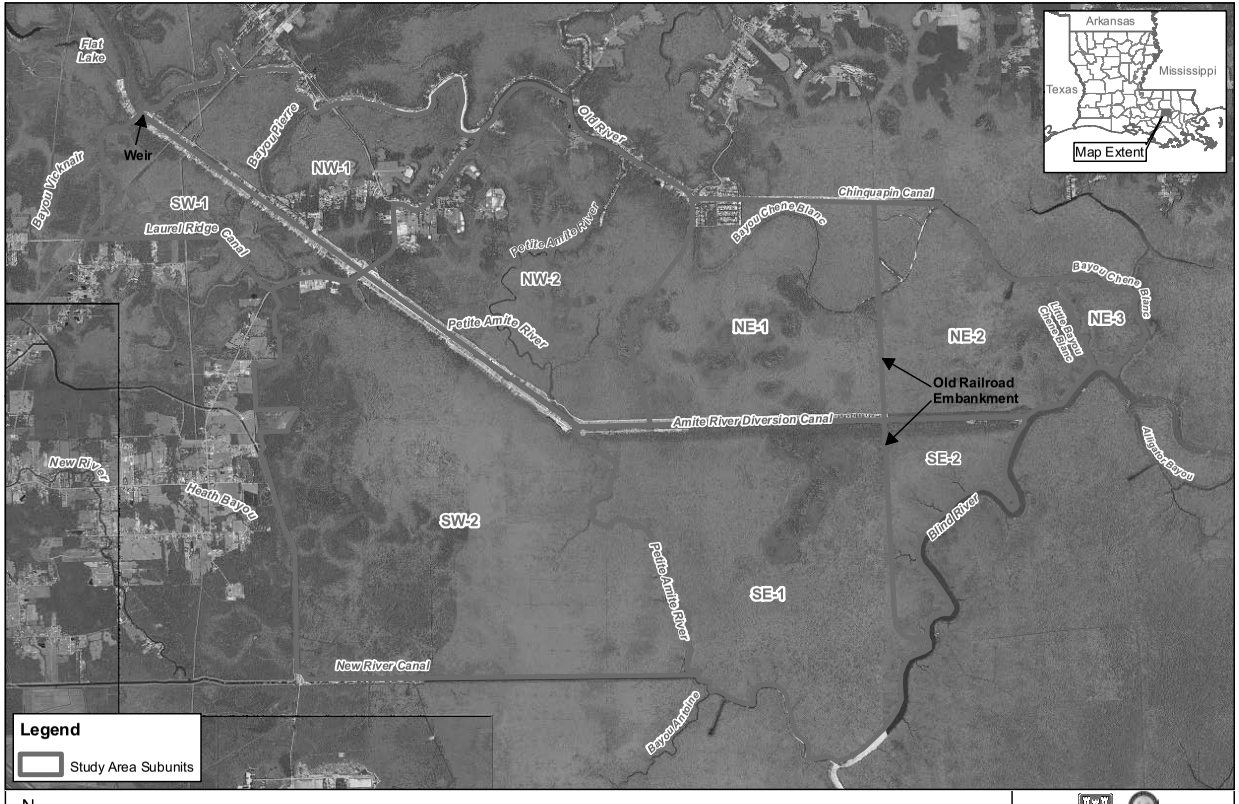
For planning purposes the study area has been divided into nine separate hydrologic subunits (Figure 2). Each subunit was developed based on hydrologic differences that exist throughout the study area due to natural and manmade hydrologic boundaries. These boundaries include natural topography such as dredged material berms and natural ridges, as well as made-made and natural canals.



STUDY AREA REGION

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 1
Date: October 2009
Scale: 1:260,000
Source: USDA/GEC
Map ID: 27850108-1781



STUDY AREA AND SUBUNITS

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 2
Date: October 2009
Scale: 1:80,000
Source: USDA/GEC
Map ID: 27850108-1780

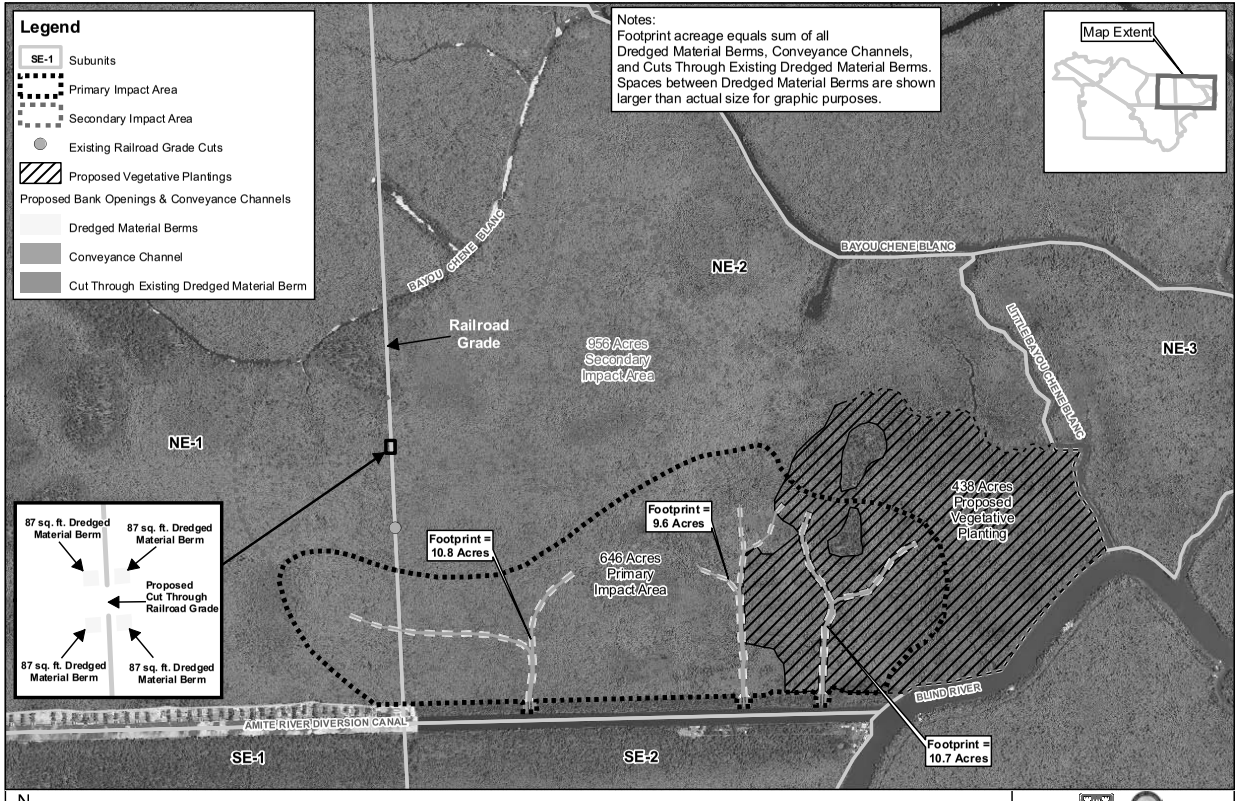
4.0 DESCRIPTION OF THE PROPOSED ACTION

Alternative 33 of the LCA ARDC Integrated Feasibility Report and Supplemental Environmental Impact Statement (SEIS) is the Tentatively Selected Plan (TSP), which is depicted in Figure 3.

Features of Alternative 33 (TSP) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Three naturally low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.



ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 3
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868

5.0 GUIDELINES

1. GUIDELINES APPLICABLE TO ALL USES

Guideline 1.1 The guidelines must be read in their entirety. Any proposed use may be subject to the requirements of more than one guideline or section of guidelines and all applicable guidelines must be complied with.

Response: Acknowledged.

Guideline 1.2 Conformance with applicable water and air quality laws, standards and regulations, and with those other laws, standards and regulations which have been incorporated into the coastal resources program shall be deemed in conformance with the program except to the extent that these guidelines would impose additional requirements.

Response: Acknowledged.

Guideline 1.3 The guidelines include both general provisions applicable to all uses and specific provisions applicable only to certain types of uses. The general guidelines apply in all situations. The specific guidelines apply only to the situations they address. Specific and general guidelines should be interpreted to be consistent with each other. In the event there is an inconsistency, the specific should prevail.

Response: Acknowledged.

Guideline 1.4 These guidelines are not intended to nor shall they be interpreted so as to result in an involuntary acquisition or taking of property.

Response: No involuntary acquisition would be required for the proposed action. Oyster leases that are anticipated to be impacted would be acquired through the Louisiana Department of Natural Resources oyster lease acquisition program.

Guideline 1.5 No use or activity shall be carried out or conducted in such a manner as to constitute a violation of the terms of a grant or donation of any lands or water-bottoms to the State or any subdivision thereof. Revocations of such grants and donations shall be avoided.

Response: No violations or revocations of such grants or donations are expected.

Guideline 1.6 Information regarding the following general factors shall be utilized by the permitting authority in evaluating whether the proposed use is in compliance with the guidelines.
a) type, nature and location of use.

Response: Acknowledged.

b) elevation, soil and water conditions and flood and storm hazard characteristics of site.

Response: Acknowledged.

c) techniques and materials used in construction, operations and maintenance of use.

Response: Acknowledged.

d) existing drainage patterns and water regimes of surrounding area including flow, circulation, quality, quantity and salinity; and impacts on them.

Response: Acknowledged.

e) availability of feasible alternative sites or methods – for implementing the use.

Response: Acknowledged.

f) designation of the area for certain uses as part of a local program.

Response: Acknowledged.

g) economic need for use and extent of impacts of use on economy of locality.

Response: Acknowledged.

h) extent of resulting public and private benefits.

Response: Acknowledged.

i) extent of coastal water dependency of the use.

Response: Acknowledged.

j) existence of necessary infrastructure to support the use and public costs resulting from use.

Response: Acknowledged.

k) extent of impacts on existing and traditional uses of the area and on future uses for which the area is suited.

Response: Acknowledged.

l) proximity to, and extent of impacts on important natural features such as beaches, barrier islands, tidal passes, wildlife and aquatic habitats, and forest lands.

Response: Acknowledged.

m) the extent to which regional, state and national interests are served including the national interest in resources and the siting of facilities in the coastal zones as identified in the coastal resources program.

Response: Acknowledged.

n) proximity to, and extent of impacts on, special areas, particular areas, or other areas of particular concern of the state program or local programs.

Response: Acknowledged.

o) likelihood of, and extent of impacts of, resulting secondary impacts and cumulative impacts.

Response: Acknowledged.

p) proximity to and extent of impacts on public lands or works, or historic, recreational or cultural resources.

Response: Acknowledged.

q) extent of impacts on navigation, fishing, public access, and recreational opportunities.

Response: Acknowledged.

r) extent of compatibility with natural and cultural setting.

Response: Acknowledged.

s) extent of long term benefits or adverse impacts.

Response: Acknowledged.

Guideline 1.7 It is the policy of the coastal resources program to avoid the following adverse impacts. To this end, all uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable significant:

a) reductions in the natural supply of sediment and nutrients to the coastal system by alterations of freshwater flow.

Response: The construction of the ARDC altered the natural freshwater flow into the Maurepas Swamp. The intent of this proposed action is to offset the alteration of flow created by the ARDC dredged material placement areas, to provide hydrologic connectivity, and to promote the supply of sediment and nutrients to the swamp.

b) adverse economic impacts on the locality of the use and affected governmental bodies.

Response: The proposed action is not expected to have any adverse economic impacts on the locality of the use or on nearby governmental bodies. No industries, jobs, or other economic activities would be adversely impacted by the proposed action.

c) detrimental discharges of inorganic nutrient compounds into coastal waters.

Response: No detrimental discharges of inorganic nutrient compounds would occur.

d) alterations in the natural concentration of oxygen in coastal waters.

Response: There may be a temporary decrease in the dissolved oxygen concentrations during actual construction operations, as well as for a short time thereafter. Any effects are expected to be minor and would occur only during actual dredging activities. Dissolved oxygen levels would return to ambient levels following construction operations.

e) destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and water bottoms, beaches, dunes, barrier islands, and other natural biologically valuable areas or protective coastal features.

Response: No adverse alterations of water bodies would result from the proposed action. Instead, improved hydrologic connectivity would result.

f) adverse disruption of existing social patterns.

Response: Any disruptions of social patterns would be associated with construction activities, and would be of a short-term nature.

g) alterations of the natural temperature regime of coastal waters.

Response: No alterations of the natural temperature regime are expected to.

h) detrimental changes in existing salinity regimes.

Response: The proposed action would not alter natural salinity regimes in or around the project area. Salt water introduced by storm tides currently becomes impounded behind the ARDC dredged material placement areas. By reestablishing hydrologic connectivity between the swamps and surrounding waterways, the proposed action would promote the flushing of salt water from freshwater swamps.

i) detrimental changes in littoral and sediment transport processes.

Response: No detrimental changes in transport processed would occur. Rather, the proposed action would improve the transport of sediments into swamps.

j) adverse effects of cumulative impacts.

Response: Cumulative impacts represent the effects of this proposed action in association with other past, present, and reasonably foreseeable future projects. This proposed action provides beneficial environmental effects and would not contribute to adverse effects of cumulative impacts.

k) detrimental discharges of suspended solids into coastal waters, including turbidity resulting from dredging.

Response: There would be a temporary increase in turbidity and suspended solids during construction (dredging and placement) of project features. However, any effects would be temporary and conditions would return to ambient following completion of construction activities.

l) reductions or blockage of water flow or natural circulation patterns within or into an estuarine system or a wetland forest.

Response: The intent of this proposed action is to alleviate blockages within the project area created by the construction of the ARDC and to promote hydrologic connectivity.

m) discharges of pathogens or toxic substances into coastal waters.

Response: There are no known toxic or pathogenic substance levels that are expected to significantly increase due to implementing the proposed action.

n) adverse alteration or destruction of archaeological, historical, or other cultural resources.

Response: Adverse alteration or destruction of cultural resources is not expected to occur.

o) fostering of detrimental secondary impacts in undisturbed or biologically highly productive wetland areas.

Response: Adverse impacts to wetlands would not result. As demonstrated through Wetland Value Assessments, the proposed action would improve the quality of wetlands. There would be an overall net gain of 679 Average Annual Habitat Units (AAHUs).

p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands.

> **Response:** No unique or valuable habitats would be adversely affected; the cypress-tupelo swamps of the area would be improved by the proposed action. The project area does not contain critical habitat for endangered species. The improvement in hydrologic connectivity would enhance the area for fish and wildlife habitats, including breeding areas. A portion of the Maurepas Swamp Wildlife Management Area located in the project area would not be adversely affected.

q) adverse alteration or destruction of public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern.

> **Response:** No public parks, shoreline access points, public works, or designated recreation areas would be adversely altered by the proposed action. Blind River, which abuts the project area is a designated scenic river, would not be adversely affected.

r) adverse disruptions of coastal wildlife and fishery migratory patterns.

> **Response:** The proposed action would not disrupt coastal wildlife or fishery migratory patterns. Rather, the restoration of hydrologic connectivity to the swamp may improve the ingress and egress of aquatic organisms between the swamps and surrounding water bodies.

s) land loss, erosion and subsidence.

> **Response:** The proposed action would not adversely affect land loss, erosion, or subsidence. By improving the quality of swamp habitats through improved hydrologic connectivity and the resulting introduction of nutrients into the swamp, it is anticipated that improved subsurface growth of root masses would elevate ground levels.

t) increases in the potential for flood, hurricane or other storm damage, or increases in the likelihood that damage will occur from such hazards.

Response: The proposed action is not expected to increase the potential for flood, hurricane, or other storm damage, or increase the likelihood of damage from such hazards.

u) reductions in the long-term biological productivity of the coastal ecosystem.

Response: As demonstrated through Wetland Value Assessment determinations, the proposed action would improve the quality of the ecosystem in the project area. There would be an overall net gain of 679 AAHUs.

Guideline 1.8 In those guidelines in which the modifier "maximum extent practicable" is used, the proposed use is in compliance with the guideline if the standard modified by the term is complied with. If the modified standard is not complied with, the use will be in compliance with the guideline if the permitting authority finds, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in guideline 1.6, and a balancing of their relative significance, that the benefits resulting from the proposed use would clearly outweigh the adverse impacts resulting from non compliance with the modified standard and there are no feasible and practical alternative locations, methods and practices for the use that are in compliance with the modified standard and: a) significant public benefits will result from the use, or; b) the use would serve important regional, state or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or; the use is coastal water dependent. The systematic consideration process shall also result in a determination of those conditions necessary for the use to be in compliance with the guideline. Those conditions shall assure that the use is carried out utilizing those locations, methods and practices which maximize conformance to the modified standard; are technically, economically, environmentally, socially and legally feasible and practical and minimize or offset those adverse impacts listed in guideline 1.7 and in the guideline at issue.

Response: Acknowledged.

Guideline 1.9 Uses shall to the maximum extent practicable be designed and carried out to permit multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses of the vicinity.

Response: Generally, the project area would only be unavailable for use during construction activities. The project area would again be available for multiple uses following actual construction operations. Natural waterways would not be closed.

Guideline 1.10 These guidelines are not intended to be, nor shall they be, interpreted to allow expansion of governmental authority beyond that established by La. R.S. 49:213.1 through 213.21, as amended; nor shall these guidelines be interpreted so as to require permits for specific uses legally commenced or established prior to the effective date of the coastal use permit program nor to normal maintenance or repair of such uses.

Response: Acknowledged.

2. GUIDELINES FOR LEVEES

Guideline 2.1 The leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Response: The proposed action would not involve the construction of levees.

Guideline 2.2 Levees shall be planned and sited to avoid segmentation of wetland areas and systems to the maximum extent practicable.

Response: The proposed action would not involve the construction of levees.

Guideline 2.3 Levees constructed for the purpose of developing or otherwise changing the use of a wetland area shall be avoided to the maximum extent practicable.

Response: The proposed action would not involve the construction of levees.

Guideline 2.4 Hurricane and flood protection levees shall be located at the non wetland/wetland interface or landward to the maximum extent practicable.

Response: The proposed action would not involve the construction of levees.

Guideline 2.5 Impoundment levees shall only be constructed in wetland areas as part of approved water or marsh management projects or to prevent release of pollutants.

Response: The proposed action would not involve the construction of levees.

Guideline 2.6 Hurricane or flood protection levee systems shall be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients and aquatic organisms between enclosed wetlands and those outside the levee system.

Response: The proposed action would not involve the construction of levees.

3. GUIDELINES FOR LINEAR FACILITIES

Guideline 3.1 Linear use alignments shall be planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas.

Response: Bifurcated conveyance channels would be dredged in wetlands to enhance the hydrologic connectivity through the expansion of the interface between the swamp and the ARDC. While this would convert a portion of the swamp to open water, the overall effect would be to improve the net quality of the wetland habitat in the project area.

Guideline 3.2 Linear facilities involving the use of dredging or filling shall be avoided in wetland and estuarine areas to the maximum extent practicable.

Response: Bifurcated conveyance channels would be dredged in wetlands to enhance the hydrologic connectivity through the expansion of the interface between the swamp and the ARDC. While this would convert a portion of the swamp to open water, the overall effect would be to improve the net quality of the wetland habitat in the project area.

Guideline 3.3 Linear facilities involving dredging shall be of the minimum practical size and length.

Response: Acknowledged.

Guideline 3.4 To the maximum extent practicable, pipelines shall be installed through the "push ditch" method and the ditch backfilled.

Response: Acknowledged.

Guideline 3.5 Existing corridors, rights of way, canals, and streams shall be utilized to the maximum extent practicable for linear facilities.

Response: Acknowledged.

Guideline 3.6 Linear facilities and alignments shall be, to the maximum extent practicable, designed and constructed to permit multiple uses consistent with the nature of the facility.

Response: While disruption to multiple uses of the project area may occur during construction, multiple uses of the area would be restored following construction.

Guideline 3.7 Linear facilities involving dredging shall not traverse or adversely affect any barrier island.

Response: The proposed action does not occur on or near any barrier islands.

Guideline 3.8 Linear facilities involving dredging shall not traverse beaches, tidal passes, protective reefs or other natural gulf shoreline unless no other alternative exists. If a beach, tidal pass, reef or other natural gulf shoreline must be traversed for a non navigation canal, they shall be restored at least to their natural condition immediately upon completion of construction. Tidal passes shall not be permanently widened or deepened except when necessary to conduct the use. The best available restoration techniques which improve the traversed area's ability to serve as a shoreline shall be used.

Response: The proposed action would not traverse beaches, tidal passes, protective reefs, or other natural gulf shorelines.

Guideline 3.9 Linear facilities shall be planned, designed, located and built using the best practical techniques to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Response: Acknowledged.

Guideline 3.10 Linear facilities shall be planned, designed, and built using the best practical techniques to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm generated surges. Consideration shall be given to the use of locks in navigation canals and channels which connect more saline areas with fresher areas.

Response: Acknowledged.

Guideline 3.11 All non navigation canals, channels and ditches which connect more saline areas with fresher areas shall be plugged at all waterway crossings and at intervals between crossings in order to compartmentalize them. The plugs shall be properly maintained.

Response: The proposed action would not construct any channels or canals that would adversely affect salinity patterns. Rather, the proposed action would assist in flushing salt water introduced by storm tides from the swamp, thereby improving the health of the swamp.

Guideline 3.12 The multiple use of existing canals, directional drilling and other practical techniques shall be utilized to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Response: While the proposed action would involve the construction of bifurcated conveyance channels, the channels would serve to enhance the quality of the wetlands and improve fish and wildlife habitats.

Guideline 3.13 All pipelines shall be constructed in accordance with parts 191, 192, and 195 of Title 49 of the Code of Federal Regulations, as amended, and in conformance with the Commissioner of Conservation's Pipeline Safety Rules and Regulations and those safety requirements established by La. R. S. 45:408, whichever would require higher standards.

Response: Acknowledged.

Guideline 3.14 Areas dredged for linear facilities shall be backfilled or otherwise restored to the pre existing conditions upon cessation of use for navigation purposes to the maximum extent practicable.

Response: Acknowledged.

Guideline 3.15 The best practical techniques for site restoration and re-vegetation shall be utilized for all linear facilities.

Response: Acknowledged.

Guideline 3.16 Confined and dead end canals shall be avoided to the maximum extent practicable. Approved canals must be designed and constructed using the best practical techniques to avoid water stagnation and eutrophication.

Response: While the proposed action would involve the construction of bifurcated conveyance channels, the channels would serve to reestablish hydrologic connectivity, enhance the quality of the wetlands, and improve fish and wildlife habitats.

4. GUIDELINES FOR DREDGED MATERIAL DEPOSITION

Guideline 4.1 Spoil shall be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality.

Response: The placement of material dredged in association with the proposed action would not disrupt the movement, flow, circulation, or quality of water.

Guideline 4.2 Spoil shall be used beneficially to the maximum extent practicable to improve productivity or create new habitat, reduce or compensate for environmental damage done by dredging activities, or prevent environmental damage. Otherwise, existing spoil disposal areas or upland disposal shall be utilized to the maximum extent practicable rather than creating new disposal areas.

Response: Material excavated from construction activities associated with the removal of the existing dredged material berm along the ARDC and the railroad grade would be placed in adjacent wetland areas to create bottomland hardwood (BLH) "islands" that would serve as refuges for wildlife during times of flooding. All material dredged during construction of the conveyance channels would be placed along

alternating portions of the channels to also create BLH habitat "islands." The BLH "islands" would be located to allow sufficient sheet flow to be conveyed from the swamp.

Guideline 4.3 Spoil shall not be disposed of in a manner which could result in the impounding or draining of wetlands or the creation of development sites unless the spoil deposition is part of an approved levee or land surface alteration project.

Response: The proposed action would not impound wetlands but would reduce the degree of impoundment that currently exists and provide for a more natural hydrologic regime by restoring hydrologic connections.

Guideline 4.4 Spoil shall not be disposed of on marsh, known oyster or clam reefs or in areas of submersed vegetation to the maximum extent practicable.

Response: The proposed action would not involve the placement of spoil on a marsh, oyster or clam reefs, or areas of submerged vegetation.

Guideline 4.5 Spoil shall not be disposed of in such a manner as to create a hindrance to navigation or fishing, or hinder timber growth.

Response: The proposed action would not create a hindrance to navigation or fishing, or hinder timber growth.

Guideline 4.6 Spoil disposal areas shall be designed and constructed and maintained using the best practical techniques to retain the spoil at the site, reduce turbidity, and reduce shoreline erosion when appropriate.

Response: Best management practices would be employed to retain dredged material and minimize turbidity resulting from dredging activities.

Guideline 4.7 The alienation of state owned property shall not result from spoil deposition activities without the consent of the Department of Natural Resources.

Response: The proposed action would not result in the alienation of state owned property.

5. GUIDELINES FOR SHORELINE MODIFICATION

Guideline 5.1 Non structural methods of shoreline protection shall be utilized to the maximum extent practicable.

Response: Acknowledged.

Guideline 5.2 Shoreline modification structures shall be designed and built using best practical techniques to minimize adverse environmental impacts.

Response: Acknowledged.

Guideline 5.3 Shoreline modification structures shall be lighted or marked in accordance with U.S. Coast Guard regulations, not interfere with navigation, and should foster fishing, other recreational opportunities, and public access.

Response: Acknowledged.

Guideline 5.4 Shoreline modification structures shall be built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters.

Response: Acknowledged.

Guideline 5.5 Piers and docks and other harbor structures shall be designed and built using best practical techniques to avoid obstruction of water circulation.

Response: The proposed action would not construct any piers, docks, or other harbor structures.

Guideline 5.6 Marinas, and similar commercial and recreational developments shall to the maximum extent practicable not be located so as to result in adverse impacts on open productive oyster beds, or submersed grass beds.

Response: The proposed action would not construct any marinas or similar commercial or recreational developments.

Guideline 5.7 Neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures shall be removed at the owner's expense, when appropriate.

Response: Acknowledged.

Guideline 5.8 Shoreline stabilization structures shall not be built for the purpose of creating fill areas for development unless part of an approved surface alteration use.

Response: Acknowledged.

Guideline 5.9 Jetties, groins, breakwaters and similar structures shall be planned, designed and constructed so as to avoid to the maximum extent practicable downstream land loss and erosion.

Response: Acknowledged.

6. GUIDELINES FOR SURFACE ALTERATIONS

Guideline 6.1 Industrial, commercial, urban, residential, and recreational uses are necessary to provide adequate economic growth and development. To this end, such uses will be encouraged in those areas of the coastal zone that are suitable for development. Those uses shall be consistent with the other guidelines and shall, to the maximum extent practicable, take place only:

a) on lands five feet or more above sea level or within fast lands; or

b) on lands which have foundation conditions sufficiently stable to support the use, and where flood and storm hazards are minimal or where protection from these hazards can be reasonably well achieved, and where the public safety would not be unreasonably endangered; and

1) the land is already in high intensity of development use, or

2) there is adequate supporting infrastructure, or

3) the vicinity has a tradition of use for similar habitation or development

Response: Acknowledged.

Guideline 6.2 Public and private works projects such as levees, drainage improvements, roads, airports, ports, and public utilities are necessary to protect and support needed development and shall

be encouraged. Such projects shall, to the maximum extent practicable, take place only when:
a) they protect or serve those areas suitable for development pursuant to Guideline
6.1; and b) they are consistent with the other guidelines; and c) they are consistent with all relevant adopted state, local and regional plans.

Response: Not applicable.

Guideline 6.3 BLANK (Deleted by Louisiana Department of Natural Resources)

Guideline 6.4 To the maximum extent practicable wetland areas shall not be drained or filled. Any approved drain or fill project shall be designed and constructed using best practical techniques to minimize present and future property damage and adverse environmental impacts.

Response: No wetlands would be filled for development purposes as a result of the proposed action. However, the proposed action is intended to promote the draining of impoundments created by the construction of the ARDC. The reestablishment of a more natural hydrologic connectivity would improve the quality of the swamp habitat.

Guideline 6.5 Coastal water dependent uses shall be given special consideration in permitting because of their reduced choice of alternatives.

Response: Not applicable.

Guideline 6.6 Areas modified by surface alteration activities shall, to the maximum extent practicable, be re-vegetated, refilled, cleaned and restored to their predevelopment condition upon termination of the use.

Response: The proposed action is intended to promote the draining of impoundments created by the construction of the ARDC. Revegetation of degraded swamp through the planting of seedlings is included as part of the proposed action.

Guideline 6.7 Site clearing shall to the maximum extent practicable be limited to those areas immediately required for physical development.

Response: Acknowledged.

Guideline 6.8 Surface alterations shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Alterations in wildlife preserves and management areas shall be conducted in strict accord with the requirements of the wildlife management body.

Response: The proposed action would not adversely affect habitats on the Maurepas Swamp Wildlife Management Area, a portion of which is located within the study area. The proposed action has been coordinated with the Louisiana Department of Wildlife and Fisheries and U.S. Fish and Wildlife Service.

Guideline 6.9 Surface alterations which have high adverse impacts on natural functions shall not occur, to the maximum extent practicable, on barrier islands and beaches, isolated cheniers, isolated natural ridges or levees,' or in wildlife and aquatic species breeding or spawning areas, or in important migratory routes.

Response: The proposed action would not alter barrier islands, beaches, isolated cheniers, isolated natural ridges or levees. The proposed action is anticipated to improve the quality of wildlife and aquatic species breeding/spawning areas through improvement of the quality of wetland habitats.

Guideline 6.10 The creation of low dissolved oxygen conditions in the water or traps for heavy metals shall be avoided to the maximum extent practicable.

Response: By relieving the impoundments currently adversely affecting the study area, the proposed action is expected to improve the quality of water in the swamps, including dissolved oxygen conditions. No traps for heavy metals are anticipated to occur. The proposed action may temporarily create low dissolved oxygen conditions due to increased turbidity associated in the immediate vicinity of construction activities. However, any such conditions would be of short duration and would return to ambient conditions after construction activities were completed.

Guideline 6.11 Surface mining and shell dredging shall be carried out utilizing the best practical techniques to minimize adverse environmental impacts.

Response: Not applicable.

Guideline 6.12 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response: No underwater obstructions would result from the proposed action.

Guideline 6.13 Surface alteration sites and facilities shall be designed, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment and minimize other adverse impacts.

Response: Acknowledged.

Guideline 6.14 To the maximum extent practicable only material that is free of contaminants and compatible with the environmental setting shall be used as fill.

Response: Fill would be native material from adjacent areas. No contaminants are anticipated to be present.

7. GUIDELINES FOR HYDROLOGIC AND SEDIMENT TRANSPORT MODIFICATIONS

Guideline 7.1 The controlled diversion of sediment laden waters to initiate new cycles of marsh building and sediment nourishment shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: The proposed action does not include the controlled diversion of sediment-laden water.

Guideline 7.2 Sediment deposition systems may be used to offset land loss, to create or restore wetland areas or enhance building characteristics of a development site. Such systems shall only be utilized as part of an approved plan. Sediment from these systems shall only be discharged in the area that the proposed use is to be accomplished.

Response: Material excavated from construction activities associated with the removal of the existing dredged material berm along the ARDC and the railroad grade would be placed in adjacent wetland areas to create bottomland hardwood (BLH) “islands” that would serve as refuges for wildlife during times of flooding. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps, to also create BLH habitat "islands." The BLH "islands" would be located to allow sufficient sheet flow to be conveyed from the swamp.

Guideline 7.3 Undesirable deposition of sediments in sensitive habitat or navigation areas shall be avoided through the use of the best preventive techniques.

Response: Acknowledged.

Guideline 7.4 The diversion of freshwater through siphons and controlled conduits and channels, and overland flow to offset saltwater intrusion and to introduce nutrients into wetlands shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: The proposed action does not include such diversions.

Guideline 7.5 Water or marsh management plans shall result in an overall benefit to the productivity of the area.

Response: Acknowledged.

Guideline 7.6 Water control structures shall be assessed separately based on their individual merits and impacts and in relation to their overall water or marsh management plan of which they are a part.

Response: The proposed action does not include water control structures.

Guideline 7.7 Weirs and similar water control structures shall be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms.

Response: The proposed action does not include water control structures.

Guideline 7.8 Impoundments which prevent normal tidal exchange and/or the migration of aquatic organisms shall not be constructed in brackish and saline areas to the maximum extent practicable.

Response: The proposed action does not include the creation of impoundments.

Guideline 7.9 Withdrawal of surface and ground water shall not result in saltwater intrusion or land subsidence to the maximum extent practicable.

Response: Not applicable.

8. GUIDELINES FOR DISPOSAL OF WASTES

Response: The proposed action would not involve the disposal of wastes and, therefore, these guidelines are not applicable.

9. GUIDELINES FOR USES THAT RESULT IN THE ALTERATION OF WATERS DRAINING INTO COASTAL WATERS

Response: The proposed action would not involve the alteration of waters draining into coastal waters and, therefore, these guidelines are not applicable.

10. GUIDELINES FOR OIL, GAS, AND OTHER MINERAL ACTIVITIES

Response: The proposed action would not involve oil, gas, and other mineral activities and, therefore, these guidelines are not applicable.

Geotechnical investigations will be implemented during the Preconstruction Engineering, and Design (PED) phase of the LCA ARDC project. This project is located north of the ARDC, in Livingston Parish. There is only one land owner in this location, Blind River Properties Inc., owned by Mr. Glen Martin. We have contacted Mr. Martin to inform him of the proposed investigations, to which he has no objection. The soil borings needed for this project shall be 5 inches as required by the COE. To retrieve these samples the contractor will need an air boat, personal buggy, swamp buggy, and marsh excavator on site. All of which will be on marsh buggy tracks. These tracks disperse the weight of the vehicle to minimize adverse impacts on the

terrain on which it traverses. A site visit was made with the drilling contractor to determine and establish the path of least impact for boring operations. From this site visit boring locations were moved in line with one another and closer to the spoil bank, some as much as 1,000 feet. This reduced the amount of unnecessary travel to and from each boring; which will be made perpendicular to the Diversion Canal and in a direct path as possible to the next boring. The contractor is not limited to the straightest path, but the path which is least damaging to the surrounding swamp.

OTHER STATE POLICIES INCORPORATED INTO THE PROGRAM

Section 213.8A of Act 361 directs the Secretary of Department of Transportation and Development (DOTD), in developing the Louisiana Coastal resources Program (LCRP), to include all applicable legal and management provisions that affect the coastal zone or are necessary to achieve the purposes of Act 361 or to implement the guidelines effectively. It states:

> *The Secretary shall develop the overall state coastal management program consisting of all applicable constitutional provisions, laws and regulations of this state which affect the coastal zone in accordance with the provisions of this Part and shall include within the program such other applicable constitutional or statutory provisions, or other regulatory or management programs or activities as may be necessary to achieve the purposes of this Part or necessary to implement the guidelines hereinafter set forth. The constitutional provisions and other statutory provisions, regulations, and management and regulatory programs incorporated into the LCRP are identified and described in Appendix 1. A description of how these other authorities are integrated into the LCRP and coordinated during program implementation is presented in Chapter IV. Since all of these policies are incorporated into the LCRP, Federal agencies must ensure that their proposed actions are consistent with these policies as well as the coastal use guidelines (CZMA, Section 307).*

CONSISTENCY DETERMINATION

Based on this evaluation, and the findings of the accompanying Integrated Feasibility Report and SEIS, the USACE, New Orleans District, has determined that the proposed is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

PREPARER

This document was prepared by GEC, Inc., for Dr. William P. Klein, Jr., Environmental Analysis Branch, Planning Division, of the New Orleans District of the U.S. Army Corps of Engineers.

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BOBBY JINDAL
GOVERNOR

ROBERT D. HARPER
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

July 22, 2010

Dr. William Klein, Jr.
U.S. Army Corps of Engineers
New Orleans District
CEMVN-PM-RS
PO Box 60267
New Orleans, LA 70160-0267

RE: **C20100168,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
LCA Amite River Diversion Canal Modification
Livingston and Ascension Parishes, Louisiana

Dear Dr. Klein:

This office has received the above referenced federal application for consistency review with the approved Louisiana Coastal Resources Program in accordance with Section 307(c) of the Federal Coastal Zone Management Act of 1972, as amended. NOAA Regulations on Federal Consistency, at 15 CFR '930.41(a), allow 60 days for the review of Direct Federal Activities, and at '930.41(b) allow an additional 15 days with appropriate applicant notification. Please be advised that, by this letter, Interagency Affairs/Field Services Division is requesting the 15 day time extension. The new due date will be August 6, 2010.

A final determination will be made within the authorized time period. Please refer to the above Consistency Application number when responding to this letter. If you have any questions please call Carol Crapanzano of the Consistency Section at (225) 342-9425.

Sincerely,

Gregory J. DuCote
Administrator
Interagency Affairs/Field Services Division

GJD/JDH/cmc
cc: Renee Sanders, CPRA

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BOBBY JINDAL
GOVERNOR

ROBERT D. HARPER
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

August 9, 2010

Joan Exnicios
Chief, Environmental Branch
Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267

RE: **C20100168,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
LCA Ecosystem Restoration for Amite River Diversion Canal Modification, **Livingston and Ascension Parishes, Louisiana**

Dear Ms. Exnicios:

The above referenced project has been reviewed for consistency with the Louisiana Coastal Resources Program in accordance with Section 307 (c) of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in this application, is consistent with the LCRP, provided the Corps complies with the LDWF stipulations with which your agency concurred by email of July 28, 2010.

If you have any questions concerning this determination please contact Brian Marcks of the Consistency Section at (225) 342-7939 or 1-800-267-4019.

Sincerely yours,
Linda Pace for Gregory DuCote

Gregory J. DuCote
Administrator
Interagency Affairs/Field Services Division

GJD/JDH/bgm

cc: William Klein, COE-NOD
Bren Haase, OCPR
Dave Butler, LDWF
Chuck Spears, OCM FI
Don Burgess, Livingston Parish

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BOBBY JINDAL
GOVERNOR

ROBERT D. HARPER
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

August 4, 2010

Joan Exnicios
Chief, Environmental Branch
Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267

RE: **C20100168,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
LCA Ecosystem Restoration for Amite River Diversion Canal Modification, **Livingston and Ascension Parishes, Louisiana**

Dear Ms. Exnicios:

The above referenced project has been reviewed for consistency with the Louisiana Coastal Resources Program in accordance with Section 307 (c) of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in this application, is consistent with the LCRP, provided the Corps complies with LDWF stipulations and Terrebonne Levee and Conservation District stipulations that the Corps concurred with in email of July 28, 2010.

If you have any questions concerning this determination please contact Brian Marcks of the Consistency Section at (225) 342-7939 or 1-800-267-4019.

Sincerely yours,

Karl L Mog for

Gregory J. DuCote
Administrator
Interagency Affairs/Field Services Division

GJD/JDH/bgm

cc: William Klein, COE-NOD
Bren Haase, OCPR
Dave Butler, LDWF
Charles Spears, OCM FI
Don Burgess, Livingston Parish

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BOBBY JINDAL
GOVERNOR

State of Louisiana
DEPARTMENT OF WILDLIFE & FISHERIES

ROBERT J. BARHAM
SECRETARY

July 29, 2010

Gregory J. Ducote, Administrator
Louisiana Department of Natural Resources
Coastal Management Division
P.O. Box 44487
Baton Rouge, LA 70804-4487

RE: *Consistency Number: C20100168*
Applicant: Corps of Engineers - New Orleans District

Dear Mr. Ducote:

Personnel of the Louisiana Department of Wildlife and Fisheries Scenic Rivers Program have reviewed the additional information provided, regarding the LCA Amite River Diversion Canal Modification Project. Based upon this review, the following has been determined:

> The project will not adversely impact the Blind River and, therefore, no Scenic River Permit or further authorization from the Scenic Rivers Program will be required.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact LDWF Permits Coordinator Dave Butler at 225-763-3595 should you need further assistance.

Sincerely,

for

Keith Cascio
Scenic Rivers Coordinator

mw

c: Matthew Weigel, Biologist
Keith Cascio, Scenic Rivers Coordinator

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BOBBY JINDAL
GOVERNOR

State of Louisiana

DEPARTMENT OF WILDLIFE & FISHERIES

ROBERT J. BARHAM
SECRETARY

July 6, 2010

Gregory J. Ducote, Administrator
Louisiana Department of Natural Resources
Coastal Management Division
P.O. Box 44487
Baton Rouge, LA 70804-4487

RE: *Consistency Number: C20100168*
Applicant: Corps of Engineers - New Orleans District
Notice Date: June 8, 2010

Dear Mr. Ducote:

The professional staff of the Louisiana Department of Wildlife and Fisheries (LDWF) has reviewed the notice referenced above. The following recommendations have been provided by the appropriate biologist(s):

Ecological Studies:
Portions of the proposed activity are within Maurepas Swamp Wildlife Management Area. No activities shall occur on any LDWF Wildlife Management Area or Refuge without obtaining a Special Use Permit from LDWF. Please contact Chris Davis at (985) 543-4777 for more information.

This project is located in the vicinity of the Blind River, a Louisiana designated Natural and Scenic River. The applicant must obtain authorization from the Louisiana Department of Wildlife and Fisheries, Scenic Rivers Program prior to initiating any of the proposed activities within or adjacent to the banks of the Blind River. Scenic Rivers Coordinator Keith Cascio can be contacted at 318-343-4045.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact LDWF Permits Coordinator Dave Butler at 225-763-3595 should you need further assistance.

Sincerely,

Kyle F. Balkum
Biologist Program Manager

mw

c: Matthew Weigel, Biologist
Keith Cascio, Scenic Rivers Coordinator
Chris Davis, Biologist

Appendix F

INITIATION LETTERS

STATE HISTORIC PRESERVATION OFFICE COORDINATION LETTER

PROGRAMMATIC AGREEMENT

Inititation Letters

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DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

APRIL 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Mr. Scott Hutcheson
State Historic Preservation Officer
Office of Cultural Development
Department of Culture, Recreation and Tourism
P.O. Box 4427
Baton Rouge, Louisiana 70804

Dear Mr. Hutcheson:

RE: AMITE RIVER DIVERSION, ASCENSION AND LIVINGSTON PARISHES, LOUISIANA

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

The goal of this project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, to contribute to a sustainable coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and contribute to the economy and well-being of the Nation.

According to records at the Louisiana Division of Archaeology four archaeological sites are located within the project area (Attachment 2). These sites are 16LV5, 16LV91, 16LV92 and 16LV93. Information on these sites comes from site forms on file at the Division of Archaeology.

16LV5 is described as an earth and shell midden on the south bank of the Amite River dating from the Late Marksville period through the Mississippian period and is recommended as eligible for inclusion in the National Register of Historic Places.

16LV91 is described two mound complex dating to the Coles Creek Period. It is also recommended for inclusion in the National Register of Historic Places.

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16LV93 is described as a shell midden on a remnant marine terrace dating to the Coles Creek Period. It is also recommended as eligible for inclusion in the National Register of Historic Places.

In accordance with 36CFR Part 800.4(a)(3) we request that you review the attached maps and site forms and identify any other cultural properties that might be of interest to the State of Louisiana. If so please inform Mr. Gary DeMarcay at (504) 862-2039.

Thank you for your help with this project. If you have any questions or require additional information, please contact Mr. DeMarcay.

Sincerely,

Joan M Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Principal Chief Oscola Clayton M. Sylestine
Alabama Coushatta Tribe of Texas
571 State Park Rd. 56
Livingston, TX 77351

Dear Principal Chief Sylestine:

RE: Amite River Diversion

A copy of this letter and the attachments are being sent to the Alabama Coushatta Tribe of Texas Historic Preservation Officer Bryant Celestine. If you wish to see the attachments, please contact Mr. Celestine, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Alabama Coushatta Tribe of Texas. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Mr. DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Bryant J. Celestine
Historic Preservation Officer
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chairperson LaRue Parker
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009

Dear Chairperson Parker:

RE: AMITE RIVER DIVERSION

A copy of this letter and the attachments are being sent to the Caddo Nation of Oklahoma Tribal Historic Preservation Officer Mr. Robert Cast. If you wish to see the attachments, please contact Mr. Cast, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Caddo Nation of Oklahoma. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay at (504) 862-2039.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Robert Cast, Historic Preservation Officer
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chairman Lonnie L. Martin
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

Dear Chairman Martin:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Chitimacha Tribe of Louisiana Cultural Director Ms. Kimberly Walden. If you wish to see the attachments, please contact Ms. Walden, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Chitimacha Tribe of Louisiana. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Mr. DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Kimberly S. Walden, Cultural Director w/atttachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chief Gregory E. Pyle
Choctaw Nation of Oklahoma
P.O. Box Drawer 1210
Durant, OK 74701

Dear Chief Pyle:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Choctaw Nation of Oklahoma Tribal Historic Preservation Officer Mr. Terry Cole. If you wish to see the attachments, please contact Mr. Cole, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Choctaw Nation of Oklahoma. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Mr. DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Terry D. Cole, Director/THPO
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chief Kevin Sickey
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

Dear Chief Sickey:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Coushatta Tribe of Louisiana Cultural Contacts Bertney and Linda Langley. If you wish to see the attachments, please contact Mr. or Ms. Langley, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Coushatta Tribe of Louisiana. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Mr. DeMarcay.

Sincerely,

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Bertney and Linda Langley, Cultural Contacts
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chief Beasley Denson
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

Dear Chief Denson:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Mississippi Band of Choctaw Indians tribal Historic Preservation Officer, Mr. Kenneth Carleton. If you wish to see the attachments, please contact Mr. Carleton, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Mississippi Band of Choctaw Indians. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Kenneth H. Carleton, Historic Preservation Officer
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chairman John Berrey
Quapaw Tribe of Oklahoma
P.O. Box 765
Quapaw, OK 74363

Dear Chairman Berrey:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Quapaw Tribe of Oklahoma Historic Preservation Officer, Ms. Carrie Wilson. If you wish to see the attachments, please contact Ms. Wilson, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Quapaw Tribe of Oklahoma. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Carrie V. Wilson, Historic Preservation Officer
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chairman Mitchell Cypress
Seminole Tribe of Florida
6300 Sterling Rd.
Hollywood, FL 33024

Dear Chairman Cypress:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Seminole Tribe of Florida Historic Preservation Officer, Mr. Willard Steele. If you wish to see the attachments, please contact Mr. Steele, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

The goal of this project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, to contribute to a sustainable coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and contribute to the economy and well-being of the Nation.

According to records at the Louisiana Division of Archaeology four archaeological sites are located within the project area (Attachment 2). These sites are 16LV5, 16LV91, 16LV92 and 16LV93. Information on these sites comes from site forms on file at the Division of Archaeology.

16LV5 is described as an earth and shell midden on the south bank of the Amite River dating from the Late Marksville period through the Mississippian period and is recommended as eligible for inclusion in the National Register of Historic Places.

16LV91 is described two mound complex dating to the Coles Creek Period. It is also recommended for inclusion in the National Register of Historic Places.

16LV92 is described as a roughly oval midden dating to the Coles Creek Period. It is also recommended for inclusion in the National Register of Historic Places.

16LV93 is described as a shell midden on a remnant marine terrace dating to the Coles Creek Period. It is also recommended as eligible for inclusion in the National Register of Historic Places.

In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Seminole Tribe of Florida. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Willard S. Steele, Tribal Historic Preservation Officer
w/attachments

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

Arpil 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Principal Chief Enoch Kelley Haney
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Dear Chief Haney:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Seminole Nation of Oklahoma Tribal Historic Preservation Officer, Ms. Natalie Deere. If you wish to see the attachments, please contact Ms. Deere, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Seminole Nation of Oklahoma. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay.

Sincerely,

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Natalie Deere
Tribal Historic Preservation Officer

Enclosure

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Chairman Earl J. Barbry, Sr.
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

Dear Chairman Barbry:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Tunica-Biloxi Tribe of Louisiana Cultural Director Mr. Earl Barbry, Jr. If you wish to see the attachments, please contact Mr. Barbry, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

The goal of this project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, to contribute to a sustainable coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and contribute to the economy and well-being of the Nation.

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In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Tunica-Biloxi Tribe of Louisiana. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

cc: Earl Barbry, Jr. Cultural Director

Enclosure

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 27, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
And Compliance Branch
Attn: CEMVN-PM-RN

Principal Chief Christine Norris
Jena Band of the Choctaw Indians
P.O. Box 14
Jena, LA 71342

Dear Chief Norris:

RE: AMITE RIVER DIVERSION

A Copy of this letter and the attachments are being sent to the Coushatta Tribe of Louisiana Cultural Contacts Bertney and Linda Langley. If you wish to see the attachments, please contact Mr. or Ms. Langley, or, if you wish you may contact Mr. Gary DeMarcay of my staff at (504) 862-2039.

The U.S. Army Corps of Engineers, New Orleans District plans to construct gaps in the existing dredged material banks of the Amite River Diversion canal to allow floodwaters to introduce additional nutrients and sediment into the western Maurepas Swamp (attachment 1). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. Nutrients and sediment associated with the freshwater would be delivered to the swamp to facilitate organic deposition in the swamp, improve biological productivity, and prevent further habitat deterioration. The gaps would also allow the swamps to drain during seasonal low-flow events on the river, which would promote seedling germination and survival. In addition, the gaps would help prevent the swamp habitat from converting to freshwater marsh or open water.

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16LV93 is described as a shell midden on a remnant marine terrace dating to the Coles Creek Period. It is also recommended as eligible for inclusion in the National Register of Historic Places.

In accordance with 36CFR Part 800.4(a)(4) we request that you review the attached maps and identify any cultural properties that may be of interest to the Alabama Coushatta Tribe of Texas. If so, please contact the Louisiana State Historic Preservation Officer at (225) 342-8170 or Mr. DeMarcay at the number above.

Thank you for your help with this project. If you have any questions or require additional information, please contact Gary DeMarcay at the number above.

Sincerely,

Joan Exnicios

Joan Exnicios, Acting
Chief, Environmental Planning
And Compliance Branch

Cc: Lillie McCormick, Environmental Director
w/attachments

SHPO Letter

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106 RF
1/19/10

MITCHELL J. LANDRIEU
LIEUTENANT GOVERNOR

State of Louisiana
OFFICE OF THE LIEUTENANT GOVERNOR
DEPARTMENT OF CULTURE, RECREATION & TOURISM
OFFICE OF CULTURAL DEVELOPMENT
DIVISION OF ARCHAEOLOGY

PAM BREAUX
SECRETARY

SCOTT HUTCHESON
ASSISTANT SECRETARY

January 19, 2010

Ms. Joan Exnicios
Environmental Planning and Compliance Branch
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Re: Management Summary of CRM Survey
LA Division of Archaeology Report No. 22-3401
Cultural Resources Survey of Five Proposed Cuts in the Amite River Diversion Canal, Livingston Parish, Louisiana

Dear Ms. Exnicios:

We are in receipt of your letter dated January 11, 2010, transmitting two copies of the above-cited management summary. We have completed our review and have the following comments to offer.

We concur with the findings presented in the management summary that it does not appear that any significant archaeological sites or other historic properties (i.e., standing structures) will be affected by the proposed project for which the investigations were conducted. Therefore, culture resources need not be further considered during the pursuit of the project for which the investigations were conducted.

This management summary, in fact, closely follows the organization and scope of a draft report. Technical comments concerning several minor items are included with this letter. Addressing these as appropriate can be regarded as a final report. Please transmit two paper copies for our files, as well as a compact disk containing a pdf copy of the final report. Should you have any questions concerning our current comments, do not hesitate to contact Dennis Jones in the Division of Archaeology at (225) 342-6932 or by email at djones@crt.state.la.us

Sincerely,

Scott Hutcheson
State Historic Preservation Officer
SH:DJ:s

TECHNICAL COMMENTS

1. Page i, Abstract. Please specify in the Abstract that the two newly reported archaeological sites, 16LV103/16AN84 and 16LV102, are ineligible for the National Register of Historic Places.

2. Page 5, Figure 2-01. Please include an explanation in the caption of the designated formations shown in this figure. For example, what do Ppu, Hal, and Hds indicate?

3. Page 22. Table 4-01 would be improved if there was an additional column that indicated the sites' National Register status as well.

4. Page 30, Table 4.03. Byrd, Kathleen M. 1978 is listed twice, as is Jones, Dennis and Malcolm Shuman 1988, and Weinstein, Richard A. 1974.

5. Page 43 and 45. Please describe the forms completed for 16LV102 and 16LV103/16AN84 as archaeological site forms, rather than Louisiana Historic Resource Inventory Forms.

Programmatic Agreement

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

WHEREAS, the United States Army Corps of Engineers (USACE), in cooperation with the Coastal Protection and Restoration Authority of Louisiana (CPRA), has been working to reverse the current trend of coastal degradation; and

WHEREAS, the Louisiana Coastal Area Plan (LCA Plan) is the recommended plan resulting from the Louisiana Coastal Area Ecosystem Restoration Study, completed in November 2004 and recommended to the Congress by a Chief of Engineers report dated January 31, 2005; and

WHEREAS, Section 7006 of the Water Resources Development Act (WRDA) of 2007 (Public Law 110-114) includes conditional authorization for the LCA Plan; and

WHEREAS, the LCA Plan calls for a coordinated, feasible solution to the identified critical water resource problems and opportunities in coastal Louisiana and includes fifteen (15) near-term critical restoration features (Undertakings); and

WHEREAS, the USACE has determined that the restoration features are undertakings as defined in the regulations of the Advisory Council on Historic Preservation (ACHP) implementing Section 106 of the National Historic Preservation Act (36 CFR § 800) that may affect properties included in or eligible for inclusion in the National Register of Historic Places (NRHP); and

WHEREAS, the USACE has consulted with the ACHP and the Louisiana State Historic Preservation Officer (SHPO) to develop this Programmatic Agreement (Agreement) pursuant to 36 CFR § 800.14(b)(1) of the ACHP's regulations implementing Section 106; and

WHEREAS, Section 7006(e)(3) of WRDA 2007 requires submittal of additional feasibility reports on the following six (6) of the fifteen (15) near-term critical restoration features identified in the 2004 LCA Study: (1) Multipurpose Operation of Houma Navigation Canal Lock, (2) Terrebonne Basin Barrier Shoreline Restoration, (3) Small Diversion at Convent/Blind River, (4) Amite River Diversion Canal Modification, (5) Medium Diversion at White's Ditch, and (6) Convey Atchafalaya River Water to Northern Terrebonne Marshes; and authorizes construction of those six features substantially in accordance with the recommendations presented in a final report of the

Chief of Engineers if a favorable report of the Chief is completed by not later than December 31, 2010; and

WHEREAS, Section 7006(e)(1) of WRDA 2007 requires submittal of feasibility reports on the following four (4) of the fifteen (15) near-term critical restoration features identified in the 2004 LCA Study: (1) Land Bridge between Caillou Lake and the Gulf of Mexico, (2) Gulf Shoreline at Point au Fer Island, (3) Modification of Caernarvon Diversion, and (4) Modification of Davis Pond Diversion; and authorizes construction of those four features if the Secretary of the Army determines that the projects are feasible; and

WHEREAS, Section 7006(c) of WRDA 2007 requires submittal of construction reports on the following five (5) of the fifteen (15) near-term critical restoration features identified in the 2004 LCA Study: (1) Mississippi River-Gulf Outlet Environmental Restoration, (2) Small Diversion at Hope Canal, (3) Barataria Basin Barrier Shoreline Restoration, (4) Small Bayou Lafourche Reintroduction, and (5) Medium Diversion at Myrtle Grove; and authorizes construction of those five features substantially in accordance with the report of the Chief of Engineers dated January 31, 2005; and

WHEREAS, the USACE has elected to fulfill its obligations under Section 106 of the National Historic Preservation Act of 1966, as amended, through the execution and implementation of this Agreement as provided in 36 CFR § 800; and

WHEREAS, the Undertakings, including stipulations of the Agreement, are subject to provisions of the Antideficiency Act (31 U.S.C. § 1341), the unavailability of funds shall not relieve the USACE from its obligation to perform those Section 106 responsibilities set forth in the Agreement; and

WHEREAS, the USACE, ACHP, SHPO, and Indian tribes as defined in 36 CFR § 800.16(m), representatives of local governments, and other appropriate parties have consulted to develop this Agreement to define efficient and cost effective processes and protocols for taking into consideration the effects of the Undertakings upon historic properties pursuant to 36 CFR § 800.14(b)(1); and

WHEREAS, the USACE acknowledges Indian tribes as sovereign nations which have a unique government-to-government relationship with the federal government and its agencies; the USACE further acknowledges its Trust Responsibility to those recognized Indian tribes; and

WHEREAS, the USACE has notified affected Indian tribes and shall fulfill its tribal consultation responsibilities through ongoing consultation with Indian tribes that attach religious and cultural significance to historic properties that may be affected by the Undertakings; and

WHEREAS, the USACE has decided that it will invite any interested Indian tribe to sign this Agreement as a concurring party; and

WHEREAS, the CPRA has been invited to be a signatory to this Agreement; and

WHEREAS, the USACE, in coordination with the SHPO, has taken appropriate measures to identify other consulting parties and to invite such parties to participate in the development and execution of this Agreement; and

WHEREAS, the USACE has requested the participation of local governments and the public by mail during the development of this Agreement and will take appropriate steps to involve and notify those parties, as appropriate, during the implementation of the terms of this Agreement; and

NOW, THEREFORE, the USACE, ACHP, and SHPO agree that the implementation of the following stipulations will evidence that the USACE has taken into account the effects of the Undertakings upon historic properties.

STIPULATIONS

The USACE shall adhere to the process and protocols set forth in this Agreement and shall ensure the following stipulations are carried out.

I. Tribal Consultation

A. The USACE shall conduct government-to-government consultation with Indian tribes that attach religious and cultural significance to historic properties that may be affected by the Undertakings.

B. The USACE will develop protocols with Indian tribes with cultural, religious, and/or ancestral ties to the Gulf Coast region to facilitate tribal consultation regarding the potential effect of the Undertakings on properties with tribal cultural or religious significance. The USACE shall provide Indian tribes with copies of all plans, determinations, and findings provided to the SHPO to assist the Indian tribes in identifying activities that may be of interest.

C. Pursuant to this Agreement, the USACE will develop consultation protocols with each Indian tribe, as requested, within ninety (90) days of the execution of this Agreement unless that timeframe is modified by written agreement.

D. The USACE has invited the Alabama Coushatta Tribe of Texas, the Caddo Nation of Oklahoma, the Chitimacha Tribe of Louisiana, the Choctaw Nation of Oklahoma, the Coushatta Tribe of Louisiana, the Jena Band of Choctaw Indians, the Mississippi Band of Choctaw Indians, the Quapaw Tribe of Oklahoma, the Seminole Nation of Oklahoma, the Seminole Tribe of Florida, and the Tunica-Biloxi Tribe

of Louisiana to consult in the development of the Agreement. The Alabama-Coushatta Tribe of Texas and the Mississippi Band of Choctaw Indians have participated in the development of the Agreement and will each sign the Agreement as a concurring party. The USACE will provide all invited Indian tribes with a copy of the Programmatic Agreement and will invite them to sign the Agreement as concurring parties.

II. Public Involvement

A. The USACE, in coordination with the SHPO, shall identify and provide members of the public likely to be interested in the effects of the Undertakings upon historic properties with a description of the restoration features and the provisions of the Agreement.

B. The USACE will involve the public through the National Environmental Policy Act (NEPA) process, which affords all persons, organizations and government agencies the right to review and comment on proposed major federal actions that are evaluated by a NEPA document. This is known as the "scoping process." The scoping process is the initial step in the preparation of a NEPA document and will help identify (1) the range of actions (project, procedural changes), (2) alternatives (both those to be rigorously explored and evaluated and those that may be eliminated), and (3) the range of environmental resources considered in the evaluation of environmental impacts.

C. The USACE will release a draft of the NEPA document for each of the Undertakings to the public for a review period. A public meeting soliciting comments on the proposed action presented in each draft NEPA document will be held during the public comment period. Comments from this review period will be incorporated into each final NEPA document.

D. To the extent permitted under applicable federal laws and regulations, the USACE will release to the public documents developed pursuant to this Agreement, including protocols, effects determinations, and Interim Progress Reports.

III. Other Consulting Parties

A. The USACE, in coordination with the SHPO, will continue efforts during the duration of this Agreement to identify other parties with demonstrated interests in preservation issues and invite them to participate as consulting parties.

B. The USACE will document the consulting parties in the consultation process for each of the Undertakings and maintain it as part of the administrative record.

C. If any dispute arises about the right to be recognized as a consulting party, the USACE will contact the ACHP and provide all appropriate documentation. The ACHP will participate in the resolution of the issue.

IV. Identification, Evaluation, and Assessment of Effects Determinations

A. In coordination with the SHPO and Indian tribes, the USACE will develop protocols for the identification and evaluation of historic properties covered under the terms of this Agreement. Such protocols also will address applicable professional standards, documentation requirements for SHPO submissions, review procedures, and the involvement of consulting parties. Identification and evaluation protocols will be developed within ninety (90) days of the execution of this Agreement unless that timeframe is modified by written agreement.

B. The USACE, in consultation with the SHPO and Indian tribes, will define and document the area of potential effects (APE) for each of the Undertakings based on the nature of the proposed construction, existing information on the presence or absence of historic properties, the types of historic properties expected to be encountered, the physical characteristics of the APE, and the religious and cultural significance of the APE to Indian tribes. The APE associated with each restoration feature will anticipate the potential for direct, indirect, and cumulative effects upon historic properties. Identification and evaluation efforts will be limited to the APE once that APE is approved by the SHPO and Indian tribes who have signed this Agreement.

C. In the event of disagreement between the USACE, SHPO, and/or Indian tribes on the eligibility of a property for listing in the National Register of Historic Places under 36 CFR § 60, the USACE shall request a formal determination of eligibility for that property from the Keeper of the National Register of Historic Places (Keeper). The determination by the Keeper will serve as the final decision regarding the National Register eligibility of the property.

D. All standard response timeframes established under 36 CFR § 800 will apply during the interim period between the execution of this Agreement and the adoption of identification and evaluation protocols, unless otherwise agreed by the SHPO and Indian tribes. The USACE may request expedited review by the SHPO and Indian tribes on a case by case basis during the interim period.

V. Coordination of Effects Determinations

A. The USACE shall evaluate effects of each of the Undertakings on historic properties in a holistic manner. In the event the USACE determines that any aspect of an Undertaking will have an effect or adverse effect on a historic property within the restoration feature's APE, the entire restoration feature will be reviewed accordingly.

B. In the absence of alternative response timeframes identified in approved protocols developed pursuant to this Agreement, consultation under this Agreement will be concluded for USACE findings of *no historic properties affected* when the SHPO and Indian tribes have reviewed the written documentation and concur with the USACE finding or do not object within thirty (30) days of receipt of an adequately documented finding.

C. Following submission of written documentation to the SHPO and Indian tribes, the USACE may propose a finding of *no adverse effect with conditions*, as appropriate. Such conditions may include, but are not limited to:

1. Avoidance and/or preservation in-place of historic properties;

2. Unavoidable visual effects to historic properties in cases where reasonable and practicable efforts to screen views are considered and implemented; and

3. Modifications or conditions to ensure consistency with the Secretary of Interior's *Standards for the Treatment of Historic Properties* and applicable guidelines.

D. In the absence of alternative response timeframes identified in approved protocols developed pursuant to this Agreement, consultation under this Agreement will be concluded for USACE findings of *no adverse effect* or *no adverse effect with conditions* when the SHPO and Indian tribes have reviewed the written documentation and concur with the USACE finding or do not object within thirty (30) days of receipt of an adequately documented finding. The public shall also be afforded an opportunity to comment.

E. Should the SHPO and/or Indian tribes object to USACE's findings of *no historic properties affected*, findings of *no adverse effect with conditions*, findings of *no adverse effect*, or should the USACE determine that it cannot accept conditions requested by the SHPO and/or Indian tribes, the USACE shall seek to resolve such objection through consultation in accordance with Stipulation IX of this Agreement.

VI. Resolution of Adverse Effects

A. In the event that the USACE, in consultation with the SHPO and Indian tribes, determines that the implementation of an Undertaking may result in an adverse effect upon historic properties as defined in 36 CFR § 800.5(a)(1) and (2) of the ACHP's regulations, the USACE shall notify the ACHP, SHPO, Indian tribes, other consulting parties, and the public. If the project activity will affect a National Historic Landmark, the USACE shall also notify the National Park Service (NPS). The adverse effect notification shall include the documentation specified in 36 CFR § 800.11(e), subject to the confidentiality provisions of 36 CFR § 800.11(c).

B. In the absence of alternative response timeframes identified in approved protocols developed pursuant to this Agreement, the ACHP, SHPO, Indian tribes, consulting parties, including NPS, as appropriate, and the public shall be afforded an opportunity to review and comment on the adverse effect notification for a period of thirty (30) days after receipt of the adverse effect notification.

C. The USACE, in consultation with the SHPO, Indian tribes, other consulting parties, and the ACHP if they notify the parties of their participation pursuant to 36 CFR 800.6(a)(1)(iii), will develop treatment plans for the resolution of adverse effects to historic properties within sixty (60) days of the receipt of the adverse effect notification. Such treatment plans will address measures to avoid, minimize, or mitigate adverse effects on historic properties. Standard mitigation measures will be tailored to the significance of the historic property, and may address the following:

1. Public Interpretation;

2. Documentation consistent with the Level II Standards of the Historic American Building Survey/ Historic American Engineering Record (HABS/HAER);

3. Historical, Architectural or Archaeological Monographs;

4. Rehabilitation of historic buildings in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR § 68);

5. Off-site mitigation, including acquisition of property or preservation easements on property, as appropriate, containing threatened resources of comparable significance in

circumstances where there is an imminent need to proceed with construction activity and it is in the public interest;

6. Ethnographic studies;

7. Studies of traditional cultural properties;

8. Relocation of historic properties to sites approved by the SHPO as possessing similar overall character; and

9. Data recovery for archeological properties.

D. Once the consulting parties agree to a treatment plan for the resolution of adverse effects on historic properties, the parties will execute a memorandum of agreement.

E. Should the USACE, SHPO, and/or Indian tribes disagree on the proposed mitigation measures, the USACE shall seek to resolve such objection through consultation in accordance with Stipulation IX of this Agreement.

F. As specified in Section 7(a) of Public Law 86-523, as amended by Public Law 93-291 (16 U.S.C. 469c(a)), the USACE may not incur costs for data recovery activities that exceed one percent of the total amount authorized to be appropriated for the critical restoration feature, unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit and the Secretary of the Interior has concurred in the waiver in accordance with Section 208(3) of Public Law 96-515, as amended (16 U.S.C. 469c-2(3)).

VII. Unanticipated Discoveries and Effects

A. In the event that the USACE discovers a previously unidentified historic property, including archeological sites, human remains, and properties of traditional religious and cultural significance to Indian tribes, during the execution of any of the Undertakings, the USACE immediately shall secure the jobsite and suspend work in the vicinity of the affected resource. The USACE shall immediately notify the SHPO, Indian tribes consistent with tribal protocols, and other consulting parties, as appropriate, should the proposed work adversely affect a previously unidentified historic property or will adversely affect a known historic property in an unanticipated manner. In accordance with Stipulation VI of this Agreement, the USACE, in coordination with the ACHP, SHPO, Indian tribes, and other consulting parties, as appropriate, will develop standard mitigation measures. The USACE will implement the standard

mitigation measures once approved by the ACHP, SHPO, Indian tribes, and consulting parties, as appropriate.

B. In the event that the USACE discovers a previously unidentified burial, including burial sites, human skeletal remains, or burial artifacts, on private or state land during the execution of any of the Undertakings, the USACE will follow procedures established in the Louisiana Unmarked Human Burial Sites Preservation Act (R.S. 8:671-681).

C. In the event that the USACE discovers a previously unidentified burial, including burial sites, human remains or funerary objects, on federal or tribal land during the execution of any of the Undertakings, the USACE will follow procedures established by the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 and the regulations that allow for its implementation (43 CFR § 10) and the Archaeological Resources Protection Act of 1979 (Public Law 96-95; 16 U.S.C. 470aa-mm), as amended, and implementing regulations (32 CFR § 229).

D. The USACE shall insure that all contractors are made aware of the requirements of this Agreement by way of its inclusion with solicitation and award documentation. In the event that a contractor discovers a previously unidentified historic property, the contractor shall immediately notify the USACE, refrain from further project activities within the immediate vicinity of the discovery, and take reasonable efforts to avoid and minimize harm to the historic property. The USACE shall implement additional measures to secure the historic property for safety and security concerns, as appropriate.

E. In the event that previously unidentified direct adverse effects to historic properties are identified following the completion of work within an activity area, any party may provide the USACE with evidence of such effects for a period of twelve (12) months from the completion of the affecting work. The USACE, in consultation with the SHPO, Indian tribes, and ACHP, as appropriate, will review the effect in accordance with the provisions of this Agreement.

F. In the event that previously unidentified direct adverse effects to structural historic properties are identified following the completion of work within an activity area, owners of such affected properties may provide the USACE with evidence of such effects for a period of twelve (12) months from the completion of the affecting work. The USACE, in consultation with the SHPO, Indian tribes, as appropriate, and the ACHP, as appropriate, will review the effect in accordance with the provisions of this Agreement.

G. If the USACE, SHPO, Indian tribes, consulting parties, or member of the public, as appropriate, cannot agree on an appropriate course of action to address the discovery situation, the USACE shall initiate the dispute resolution process set forth in Stipulation IX of this Agreement.

H. If, during performance of any relocations, construction of any improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material, or performance of any operation, maintenance, repair, rehabilitation and replacement (OMRR&R) activities required for a critical restoration feature, the CPRA discovers a previously unidentified historic property, including archeological sites, human remains, and properties of traditional religious and cultural significance to Indian tribes, the CPRA shall immediately notify the USACE, refrain from further project activities within the immediate vicinity of the discovery, and take reasonable efforts to avoid and minimize harm to the historic property. The CPRA, in coordination with the USACE, shall follow the procedures discussed in paragraphs A. through C. of this Stipulation, as applicable. The CPRA shall not proceed with performance of any relocation or construction of any improvement that is related to such a discovery until the USACE provides written notice to the CPRA that it should proceed with such work.

I. The CPRA shall insure that its contractors are made aware of the requirements of this Agreement by way of its inclusion with solicitation and award documentation for activities related to performance of relocations, construction of improvements, or OMRR&R activities required for a critical restoration feature. In the event that a contractor discovers a previously unidentified historic property, the contractor shall immediately notify the CPRA, refrain from further project activities within the immediate vicinity of the discovery, and take reasonable efforts to avoid and minimize harm to the historic property. The CPRA shall implement additional measures to secure the historic property for safety and security concerns, as appropriate.

VIII. Treatment of Human Remains

A. Pursuant to this Agreement, the USACE, in consultation with the SHPO and Indian tribes will develop protocols within ninety (90) days of the execution of this Agreement that take into account all applicable laws and regulations for the treatment of human remains that may be encountered during any ground disturbing activities related to the Undertakings.

B. For human remains that are determined to be Native American, the USACE will develop a subset of the treatment protocols in consultation with the SHPO and Indian tribes.

C. The USACE or the CPRA, as applicable, will implement the approved treatment protocols, in consultation with the SHPO and Indian tribes, in the event human remains are encountered during any ground disturbing activities related to the Undertakings.

IX. Dispute Resolution

A. Except for the resolution of eligibility issues, as set forth in Stipulation IV.C. of this Agreement, should the SHPO, Indian tribes, or member of the public disagree on the implementation of the provisions of this Agreement, they will notify the USACE, who will seek to resolve such objection through consultation.

B. If the dispute cannot be resolved through consultation, the USACE shall forward all documentation relevant to the dispute to the ACHP, including any proposed resolution identified during consultation. Within seven days after receipt of all pertinent documentation, the ACHP may:

1. Provide the USACE with recommendations to take into account in reaching final decision regarding the dispute; or

2. Notify the USACE that it will comment pursuant to 36 CFR § 800.7(c) and provide formal comments within twenty-one (21) days.

C. Any recommendation or comment provided by the ACHP will be understood to pertain only to the subject of the dispute, and the USACE's responsibilities to fulfill all actions that are not subject of the dispute will remain unchanged.

D. If the ACHP does not provide the USACE with recommendations or notification of its intent to provide formal comments within seven (7) days, the USACE may assume that the ACHP does not object to its recommended approach and it will proceed accordingly.

X. Administration and Duration of this Agreement

A. This Agreement will become effective upon the date of execution by the final signatory. The refusal of any party invited to concur in the Agreement will not invalidate the Agreement.

B. This Agreement will remain in effect for fifteen (15) years from the date of execution, unless extended for a five-year period by written agreement negotiated by all signatories by July 2025.

C. The USACE shall provide all signatories with annual Interim Progress Reports, which will be submitted every twelve (12) months from the execution date of this Agreement.

D. The consulting parties to this Agreement shall meet annually, or as needed, to evaluate the effectiveness of this Agreement.

XI. Amendment and Termination

A. Notwithstanding any provision of this Agreement, the signatories may request that it may be amended, whereupon the signatories will consult to consider such amendment. The USACE will facilitate such consultation, including Indian tribes, within thirty (30) days of the request from one of the signatory parties. Any amendment will be in writing and will be signed by the USACE, ACHP, SHPO, and CPRA, and shall be effective on the date of the final signatory.

B. This Agreement may be terminated at the request of any of the signatory parties within thirty (30) days following written notification to all parties. In the event of termination, the USACE shall comply with 36 CFR § 800 on a case by case basis for all activities covered by the Agreement.

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Execution of this Programmatic Agreement and implementation of its terms evidences that the USACE has taken into account the effects of the LCA Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

United States Army Corps of Engineers

By: _____ Date: 28 July 2010
Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers, New Orleans District

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Execution of this Programmatic Agreement and implementation of its terms evidences that the USACE has taken into account the effects of the LCA Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Coastal Protection and Restoration Authority of Louisiana

By: _____ Date: 7/27/10
Garret Graves
Chairman
Coastal Protection and Restoration Authority of Louisiana

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Execution of this Programmatic Agreement and implementation of its terms evidences that the USACE has taken into account the effects of the LCA Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Louisiana State Historic Preservation Officer

By: Phil Boggan (by Mark Hoban Morris) Date: 7/27/10
Phil Boggan
Deputy Louisiana State Historic Preservation Officer
Louisiana Office of Cultural Development

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Execution of this Programmatic Agreement and implementation of its terms evidences that the USACE has taken into account the effects of the LCA Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Advisory Council on Historic Preservation

By: _____ Date: 7/29/10
John M. Fowler
Executive Director
Advisory Council on Historic Preservation

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Alabama Coushatta Tribe of Texas

By:_____ Date:_____
Carlos Bullock, Tribal Council Chairman

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Mississippi Band of the Choctaw Indians

By:_____ Date:_____
Beasley Denson, Chief

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Caddo Nation of Oklahoma

By:_____ Date:_____
Brenda Shemayme Edwards, Chairperson

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Chitimacha Tribe of Louisiana

By:_____ Date:_____
John Paul Darden, Chairman

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Choctaw Nation of Oklahoma

By:_____ Date:_____
Gregory E. Pyle, Chief

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Coushatta Tribe of Louisiana

By:_____ Date:_____
Kevin Sickey, Chief

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Jena Band of the Choctaw Indians

By:_____ Date:_____
Christine Norris, Principal Chief

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Quapaw Tribe of Oklahoma

By:_____ Date:_____
John Berrey, Chairman

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Seminole Nation of Oklahoma

By:_____ Date:_____
Enoch Kelley Haney, Principal Chief

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Seminole Tribe of Florida

By:_____ Date:_____
Mitchell Cypress, Chairman

Programmatic Agreement
among
the United States Army Corps of Engineers,
the Coastal Protection and Restoration Authority of Louisiana,
the Louisiana State Historic Preservation Officer,
and
the Advisory Council on Historic Preservation,
Regarding the
Louisiana Coastal Area Ecosystem Restoration Plan (LCA Plan)

Concurring Party:

Tunica-Biloxi Tribe of Louisiana

By:_____ Date:_____
Earl J. Barbry Sr., Chairman



Preserving America's Heritage

July 29, 2010

Ms. Joan M. Exnicios
Chief, New Orleans Environmental Branch
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, LA 70160-0267

REF: Louisiana Coastal Area Ecosystem Restoration Plan
Louisiana

Dear Ms. Exnicios:

The Advisory Council on Historic Preservation (ACHP) has signed the enclosed Programmatic Agreement (PA) for the referenced undertaking. Our signature completes the requirements of Section 106 of the National Historic Preservation Act (NHPA) and the ACHP's regulations at 36 CFR Part 800. As requested we have signed six original signature pages which we will return to you. Please provide us with an original, fully-executed copy of this Agreement, which is being signed in counterparts by the signatories. The original copy of the Agreement will be retained for our files. As discussed, the Corps of Engineers (Corps) should provide an original of the executed PA to each of the signatories and a copy to each concurring party.

We commend the Corps for working closely with the ACHP, and the Louisiana State Historic Preservation Officer, the Coastal Protection and Restoration Authority of Louisiana, interested Indian tribes, and other consulting parties toward resolution of adverse effects for this important environmental restoration project.

If you have any questions or need further assistance, please contact Dr. John Eddins at 202-606-8553, or by email at jeddins@achp.gov.

Sincerely,

Caroline D. Hall
Assistant Director
Federal Property Management Section
Office of Federal Agency Programs

Enclosures

ADVISORY COUNCIL ON HISTORIC PRESERVATION

1100 Pennsylvania Avenue NW, Suite 803 • Washington, DC 20004
Phone: 202-606-8503 • Fax: 202-606-8647 • achp@achp.gov • www.achp.gov

Appendix G

RESPONSES TO COMMENTS

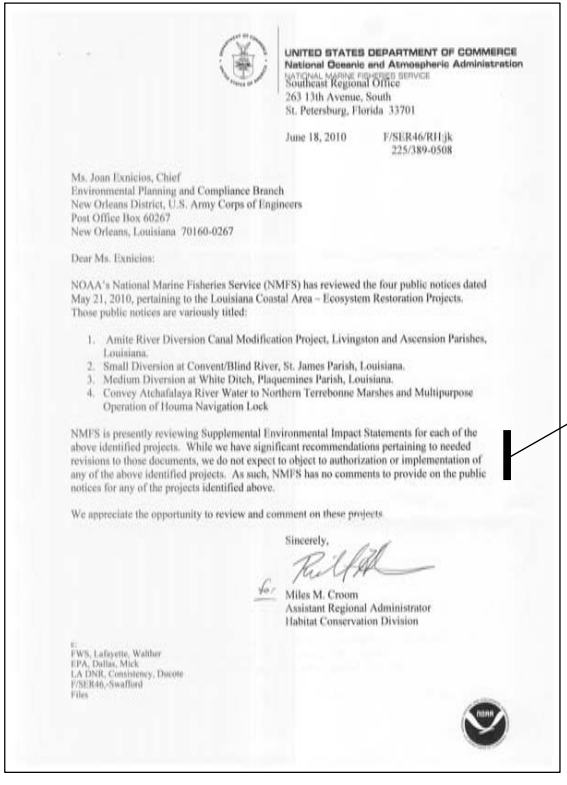
Scoping Comments/Responses

#	Comment	Response
1	Weir at French Settlement does not function properly and diverts excessive flow to ARDC, impairing lower Amite River.	Weir rehabilitation was considered as a measure in Section 3 of this study (WR-01). Changes to existing weir would have little effect on restoring degraded habitat.
2	Project should incorporate weir construction at downstream end of ARDC.	Weirs were considered as potential measures, but were screened out. This process is described in detail in Section 3 of the report (WC-01 through WC-08).
3	ARDC construction has disrupted natural hydrologic regime and damaged properties.	The objective of this project is to restore hydrologic connectivity to the area.
4	Endangered/protected species are present in the study area and vicinity.	Environmental consequences are discussed in detail in Section 5 of this report.
5	Scope of project should address wildlife and fisheries habitat.	Environmental consequences are discussed in detail in Section 5 of this report.
6	H&H modeling should be expansive, incorporate conditions from other projects, and/or involve stage data collection.	Other projects were considered in the Hydrology and Hydraulics analysis, and the study area chosen was considered adequate for the purposes of the analysis needed. The H&H analysis is included in Appendix L, Section 2.
7	Project should incorporate rehabilitation of weir at French Settlement.	Rehabilitation does not efficiently contribute to the accomplishment of the goals for this project. This was considered as a measure in section 3 of this study (WR-01)
8	Southwestern boundary of study area should be expanded.	The study area was increased from NE-1, NE-2, SE-1 and SE-2 to include areas SW-1 and SW-2.
9	Boat trips to reconnaissance study area are needed.	Several reconnaissance boat trips have been made.
10	Diversion canal stages are primarily influenced by Lake Maurepas.	Modeling shows that this is true.
11	Gap placement is an issue because of development on dredged material berms.	This was considered as a part of the project, and it was determined that the maximum benefit could be achieved without locating the gaps in developed areas.
12	Swamps south of Bayou Pierre are impaired from acidity caused by lack of hydrologic exchange.	Measures describing consideration given to Bayou Pierre are described in Section 3 (BO-01, BO-02, CD-02, CS-02, CS-03, CS-04, SR-02)
13	Project is greatly needed and should be completed on an expedited schedule.	We concur.

#	Comment	Response
14	Project should include vegetative planting or nature control.	These measures are included as a part of the TSP and are described in Section 3 (VP-01, VP-02).
15	Create hydrologic exchange between Bayou Pierre and ARDC on south canal bank.	Measures describing consideration given to Bayou Pierre are described in Section 3 (BO-01, BO-02, CD-02, CS-02, CS-03, CS-04, SR-02). No restorative opportunities exist within the Bayou Pierre area.
16	Colonial nesting waterbird rookeries are present in the study area.	Environmental consequences are discussed in detail in Section 5 of this report.
17	Draining swamp waters may impair water quality in ARDC and downstream.	No long-term water quality impacts are expected downstream of this project.
18	Project should operate under flood events, not merely normal flow or high flow conditions.	Design will operate in flood conditions.
19	Dredged material berm gapping has been implemented as part of waterfront development projects in study area.	Analysis was conducted including existing gaps as a part of this study, and the recommended plan of action was to create larger gaps to increase hydrologic connectivity.
20	Avoidance or minimization of forest habitat impacts should be considered during gap location.	The alternates were chosen based on the maximum net benefit possible, therefore minimization of impacts was considered.

Draft EIS Comments/Responses

Letter #1: National Marine Fisheries Service (NMFS)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue, South
St. Petersburg, Florida 33701

June 18, 2010 F/SER46/RH:jk
225/389-0508

Ms. Joan Exnicios, Chief
Environmental Planning and Compliance Branch
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the four public notices dated May 21, 2010, pertaining to the Louisiana Coastal Area – Ecosystem Restoration Projects. Those public notices are variously titled:

1. Amite River Diversion Canal Modification Project, Livingston and Ascension Parishes, Louisiana.
2. Small Diversion at Convent/Blind River, St. James Parish, Louisiana.
3. Medium Diversion at White Ditch, Plaquemines Parish, Louisiana.
4. Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock

NMFS is presently reviewing Supplemental Environmental Impact Statements for each of the above identified projects. While we have significant recommendations pertaining to needed revisions to those documents, we do not expect to object to authorization or implementation of any of the above identified projects. As such, NMFS has no comments to provide on the public notices for any of the projects identified above.

We appreciate the opportunity to review and comment on these projects

Sincerely,

for

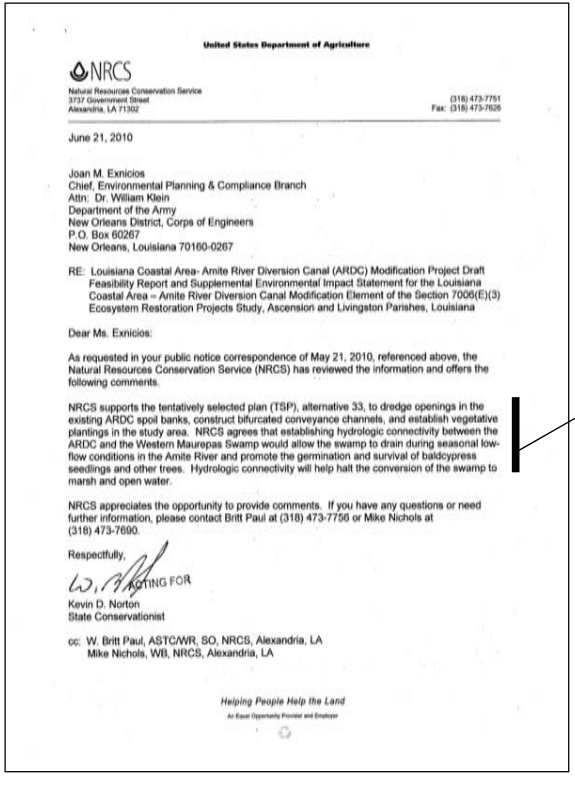
Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

c:
FWS, Lafayette, Walther
EPA, Dallas, Mick
LA DNR, Consistency, Decote
F/SER46, Swafford
Files

NMFSNO1-1: Supportive comment

815

Letter #2: Natural Resources Conservation Service (NRCS)



United States Department of Agriculture

NRCS

Natural Resources Conservation Service
3737 Government Street
Alexandria, LA 71302

(318) 473-7751
Fax: (318) 473-7626

June 21, 2010

Joan M. Exnicios
Chief, Environmental Planning & Compliance Branch
Attn: Dr. William Klein
Department of the Army
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160-0267

RE: Louisiana Coastal Area- Amite River Diversion Canal (ARDC) Modification Project Draft Feasibility Report and Supplemental Environmental Impact Statement for the Louisiana Coastal Area – Amite River Diversion Canal Modification Element of the Section 7006(E)(3) Ecosystem Restoration Projects Study, Ascension and Livingston Parishes, Louisiana

Dear Ms. Exnicios:

As requested in your public notice correspondence of May 21, 2010, referenced above, the Natural Resources Conservation Service (NRCS) has reviewed the information and offers the following comments.

NRCS supports the tentatively selected plan (TSP), alternative 33, to dredge openings in the existing ARDC spoil banks, construct bifurcated conveyance channels, and establish vegetative plantings in the study area. NRCS agrees that establishing hydrologic connectivity between the ARDC and the Western Maurepas Swamp would allow the swamp to drain during seasonal low-flow conditions in the Amite River and promote the germination and survival of baldcypress seedlings and other trees. Hydrologic connectivity will help halt the conversion of the swamp to marsh and open water.

NRCS appreciates the opportunity to provide comments. If you have any questions or need further information, please contact Britt Paul at (318) 473-7756 or Mike Nichols at (318) 473-7690.

Respectfully,

ACTING FOR
Kevin D. Norton
State Conservationist

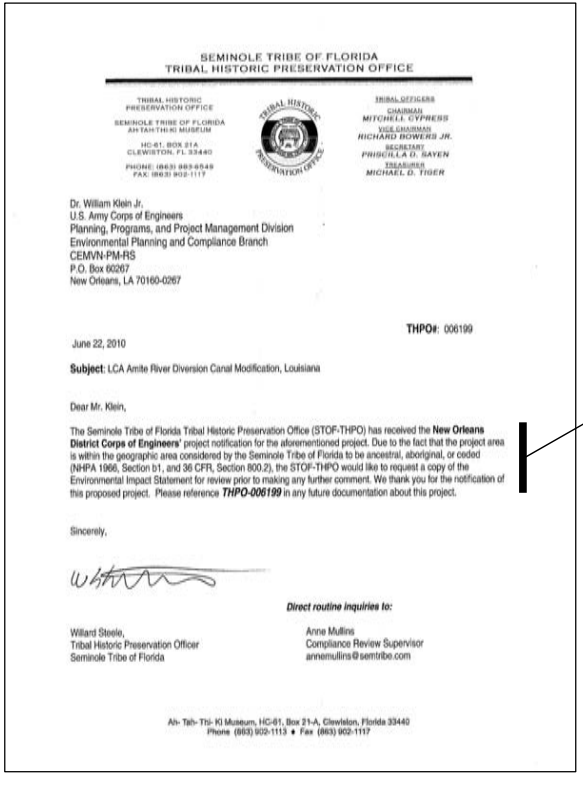
cc: W. Britt Paul, ASTC/WR, SO, NRCS, Alexandria, LA
Mike Nichols, WB, NRCS, Alexandria, LA

Helping People Help the Land

An Equal Opportunity Provider and Employer

NRCNO1-1: Supportive comment

Letter #3: Seminole Tribe of Florida (STF)



SEMINOLE TRIBE OF FLORIDA
TRIBAL HISTORIC PRESERVATION OFFICE

TRIBAL HISTORIC PRESERVATION OFFICE
SEMINOLE TRIBE OF FLORIDA
AH-TAH-THI-KI MUSEUM
HC-61, BOX 21A
CLEWISTON, FL 33440
PHONE: (863) 983-6549
FAX: (863) 902-1117

TRIBAL OFFICERS
CHAIRMAN
MITCHELL CYPRESS
VICE CHAIRMAN
RICHARD BOWERS JR.
SECRETARY
PRISCILLA D. SAYEN
TREASURER
MICHAEL D. TIGER

Dr. William Klein Jr.
U.S. Army Corps of Engineers
Planning, Programs, and Project Management Division
Environmental Planning and Compliance Branch
CEMVN-PM-RS
P.O. Box 60267
New Orleans, LA 70160-0267

THPO#: 006199

June 22, 2010

Subject: LCA Amite River Diversion Canal Modification, Louisiana

Dear Mr. Klein,

The Seminole Tribe of Florida Tribal Historic Preservation Office (STOF-THPO) has received the **New Orleans District Corps of Engineers'** project notification for the aforementioned project. Due to the fact that the project area is within the geographic area considered by the Seminole Tribe of Florida to be ancestral, aboriginal, or ceded (NHPA 1966, Section b1, and 36 CFR, Section 800.2), the STOF-THPO would like to request a copy of the Environmental Impact Statement for review prior to making any further comment. We thank you for the notification of this proposed project. Please reference ***THPO-006199*** in any future documentation about this project.

Sincerely,

Direct routine inquiries to:

Willard Steele,
Tribal Historic Preservation Officer
Seminole Tribe of Florida

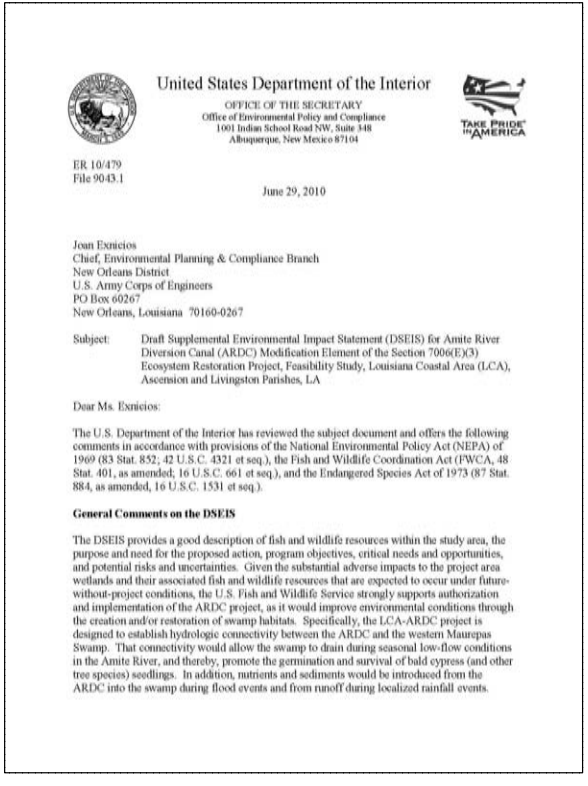
Anne Mullins
Compliance Review Supervisor
annemullins@semtribe.com

Ah- Tah- Thi- Ki Museum, HC-61, Box 21-A, Clewiston, Florida 33440
Phone (863) 902-1113 ♦ Fax (863) 902-1117

STFNO1-1: All requested material was provided for the Seminole Tribe of Florida.

819

Letter #4: United States Department of the Interior (USDOI)



United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

TAKE PRIDE IN AMERICA

ER 10/479
File 9043.1

June 29, 2010

Joan Exnicios
Chief, Environmental Planning & Compliance Branch
New Orleans District
U.S. Army Corps of Engineers
PO Box 60267
New Orleans, Louisiana 70160-0267

Subject: Draft Supplemental Environmental Impact Statement (DSEIS) for Amite River Diversion Canal (ARDC) Modification Element of the Section 7006(E)(3) Ecosystem Restoration Project, Feasibility Study, Louisiana Coastal Area (LCA), Ascension and Livingston Parishes, LA

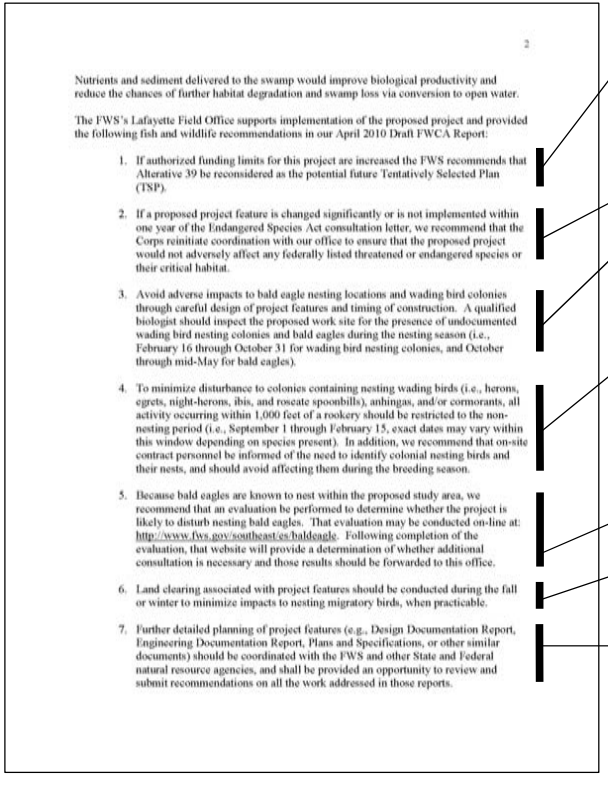
Dear Ms. Exnicios:

The U.S. Department of the Interior has reviewed the subject document and offers the following comments in accordance with provisions of the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and the Endangered Species Act of 1973 (87 Stat. 884, as amended, 16 U.S.C. 1531 et seq.).

General Comments on the DSEIS

The DSEIS provides a good description of fish and wildlife resources within the study area, the purpose and need for the proposed action, program objectives, critical needs and opportunities, and potential risks and uncertainties. Given the substantial adverse impacts to the project area wetlands and their associated fish and wildlife resources that are expected to occur under future-without-project conditions, the U.S. Fish and Wildlife Service strongly supports authorization and implementation of the ARDC project, as it would improve environmental conditions through the creation and/or restoration of swamp habitats. Specifically, the LCA-ARDC project is designed to establish hydrologic connectivity between the ARDC and the western Maurepas Swamp. That connectivity would allow the swamp to drain during seasonal low-flow conditions in the Amite River, and thereby, promote the germination and survival of bald cypress (and other tree species) seedlings. In addition, nutrients and sediments would be introduced from the ARDC into the swamp during flood events and from runoff during localized rainfall events.

Letter #4 (cont'd): United States Department of the Interior (USDOI)



2

Nutrients and sediment delivered to the swamp would improve biological productivity and reduce the chances of further habitat degradation and swamp loss via conversion to open water.

The FWS's Lafayette Field Office supports implementation of the proposed project and provided the following fish and wildlife recommendations in our April 2010 Draft FWCA Report:

1. If authorized funding limits for this project are increased the FWS recommends that Alterative 39 be reconsidered as the potential future Tentatively Selected Plan (TSP).
2. If a proposed project feature is changed significantly or is not implemented within one year of the Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with our office to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their critical habitat.
3. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. A qualified biologist should inspect the proposed work site for the presence of undocumented wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies, and October through mid-May for bald eagles).
4. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.
5. Because bald eagles are known to nest within the proposed study area, we recommend that an evaluation be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary and those results should be forwarded to this office.
6. Land clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.
7. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the FWS and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

USDOINO1-1: Concur. The proposed action is recommended with all applicable project constraints in mind, such as the WRDA 2007 cost limit. The report identifies Alternative 33 as the TSP but the NER as the long term need for the area. If additional funding becomes available the team would propose to construct additional features of the NER. Coordination is currently underway with Livingston Parish to coordinate efforts between the proposed CIAP project and the LCA project to restore the portions of the study area included in the NER plan, but not in the TSP.

USDOINO1-2: Concur. The USACE will reinitiate coordination if the project is not implemented with one year from the date the ROD is signed.

USDOINO1-3: Concur. The following language was added to Section 5.7.2 of the main report: As a result of the public review process the USFWS has requested that a qualified biologist inspect the proposed worksite for the presence of undocumented wading bird nesting colonies and bald eagles during the nesting season (i.e., February 16 through October 31 for wading bird nesting colonies and October through mid-May for bald eagles).

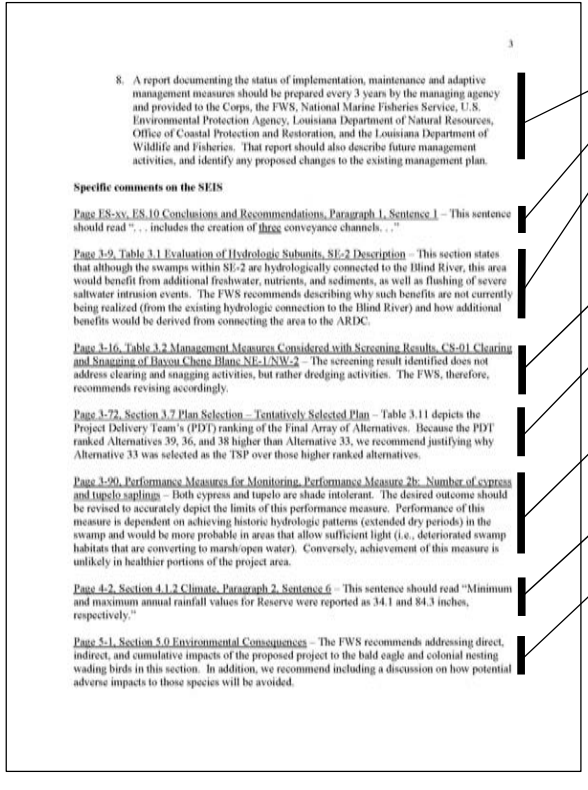
USDOINO1-4: Concur. The following language was added to Section 5.7.2 of the main report: As a result of the public review process, the USFWS recommended minimizing disturbance to colonies containing nesting wading birds, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present). In addition, the USFWS recommended that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

USDOINO1-5: Appropriate steps to determine any potential impacts to bald eagles were taken and are documented in Section 4.2.7 in Volume II of the report.

USDOINO1-6: Concur. The following language was added to Section 5.7.2 in Volume II of the report: In addition, it has been recommended by the USFWS that construction activities and/or land clearing be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

USDOINO1-7: Concur. All additional phases of this projects will be coordinated with the FWS and other State and Federal natural resource agencies, and shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

Letter #4 (cont'd): United States Department of the Interior (USDOI)



3

8. A report documenting the status of implementation, maintenance and adaptive management measures should be prepared every 3 years by the managing agency and provided to the Corps, the FWS, National Marine Fisheries Service, U.S. Environmental Protection Agency, Louisiana Department of Natural Resources, Office of Coastal Protection and Restoration, and the Louisiana Department of Wildlife and Fisheries. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

Specific comments on the SEIS

Page ES-xv, ES.10 Conclusions and Recommendations, Paragraph 1, Sentence 1 – This sentence should read ". . . includes the creation of three conveyance channels. . ."

Page 3-9, Table 3.1 Evaluation of Hydrologic Subunits, SE-2 Description – This section states that although the swamps within SE-2 are hydrologically connected to the Blind River, this area would benefit from additional freshwater, nutrients, and sediments, as well as flushing of severe saltwater intrusion events. The FWS recommends describing why such benefits are not currently being realized (from the existing hydrologic connection to the Blind River) and how additional benefits would be derived from connecting the area to the ARDC.

Page 3-16, Table 3.2 Management Measures Considered with Screening Results, CS-01 Clearing and Snagging of Bayou Cheng Blanc NE-1/NW-2 – The screening result identified does not address clearing and snagging activities, but rather dredging activities. The FWS, therefore, recommends revising accordingly.

Page 3-72, Section 3.7 Plan Selection – Tentatively Selected Plan – Table 3.11 depicts the Project Delivery Team's (PDT) ranking of the Final Array of Alternatives. Because the PDT ranked Alternatives 39, 36, and 38 higher than Alternative 33, we recommend justifying why Alternative 33 was selected as the TSP over those higher ranked alternatives.

Page 3-90, Performance Measures for Monitoring, Performance Measure 2b: Number of cypress and tupelo saplings – Both cypress and tupelo are shade intolerant. The desired outcome should be revised to accurately depict the limits of this performance measure. Performance of this measure is dependent on achieving historic hydrologic patterns (extended dry periods) in the swamp and would be more probable in areas that allow sufficient light (i.e., deteriorated swamp habitats that are converting to marsh/open water). Conversely, achievement of this measure is unlikely in healthier portions of the project area.

Page 4-2, Section 4.1.2 Climate, Paragraph 2, Sentence 6 – This sentence should read "Minimum and maximum annual rainfall values for Reserve were reported as 34.1 and 84.3 inches, respectively."

Page 5-1, Section 5.0 Environmental Consequences – The FWS recommends addressing direct, indirect, and cumulative impacts of the proposed project to the bald eagle and colonial nesting wading birds in this section. In addition, we recommend including a discussion on how potential adverse impacts to those species will be avoided.

USDOINO1-8: Concur. An adaptive management status report will be provided.

USDOINO1-9: The referenced statement was corrected to indicate that three channels are included of four.

USDOINO1-10: The following description was added to Table 3.1 in Volume II, Section 3.2.3 of the report: *Sediment, water, and nutrient connectivity and inflow from the ARDC would benefit this area, including the flushing of saltwater intrusion after tropical storm events. While connectivity with Blind River does exist within the southern portions of this subunit, overall hydrologic connectivity between the ARDC and the northern portions of this subunit would provide additional nutrients and flush saltwater intrusion introduced by high-water events via Blind River. Therefore, this subunit was retained.*

USDOINO1-11: The screening result in Table 3.2 was revised to include the following statement: *Furthermore, clearing and snagging is not needed and would result in no added flow through the bayou.*

USDOINO1-12: The following language was added to Section 3.5.2 in Volume II of the report: *These are rankings based on restoration opportunities provided by each alternative and do not take into account project constraints such as funding limitations. The rationale for selection of the TSP is further discussed in Sections 3.7 and 3.7.11.1 of this report.*

USDOINO1-13: The desired outcome was slightly changed to state *"Performance of this measure is most dependent…"* It is understood that shade could potentially influence the outcome of this measure which is one reason why densitometer and hemispherical photography measurements, which estimate the amount of crown cover, are also being measured.

USDOINO1-14: The referenced statement was updated as follows: *Minimum and maximum annual rainfall values for Reserve were reported as 34.1 and 84.3 inches, respectively.*

USDOINO1-15: The following language was added to Section 5.7.1: *"With the continued degradation of the swamp and the eventual conversion to open water, feeding opportunities for bald eagles will decline. The loss of freshwater swamp trees will decrease bald eagle nesting habitat. Similarly, nesting trees available for colonial nesting wading bird colonies would also decline."* The following language was added to Section 5.7.2: *"The increase in tree canopy would improve bald eagle and colonial waterbird nesting habitat. In addition, the quality of habitat would be improved, which would increase the abundance of prey items for wildlife, including colonial nesting wading birds and bald eagles."*

Letter #4 (cont'd): United States Department of the Interior (USDOI)

Comments on the BA

The Gulf sturgeon is an anadromous fish that occurs in many coastal rivers and streams and estuarine waters from the Atchafalaya River to the Suwanee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, and rivers and lakes of the Lake Pontchartrain basin and adjacent estuarine areas. The proposed project does not occur within Gulf sturgeon critical habitat and that species has not been reported within the ARDC. Furthermore, while there may be minor impacts to Gulf sturgeon prey species those impacts are expected to be insignificant since only a small fraction of the total ARDC water bottom would be impacted. Thus, the FWS's Louisiana Field Office concurs with your determination that the proposed activity is not likely to adversely affect the Gulf sturgeon or its critical habitat.

Federally listed as endangered, West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, including their associated coastal waters and streams, during the summer months. Manatees, within Louisiana, have also been reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes, they have also been occasionally observed elsewhere along the Louisiana coast. According to your BA, all contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area). In addition, siltation barriers, if used, would be made of material in which manatees cannot become entangled, and would be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Accordingly, the FWS's Louisiana Field Office concurs with your determination that the proposed work is not likely to adversely affect the West Indian manatee.

No further endangered species consultation will be required for this project unless there are changes in the scope or location of the work, or construction has not been initiated within 1 year. If the work has not been initiated within 1 year, follow-up consultation should be accomplished with the FWS's Louisiana Field Office prior to making expenditures for construction.

We appreciate the opportunity to provide comments on the subject document. If your staff has additional questions regarding our comments, please contact FWS's Lafayette Field Office Karen Soileau at (337) 291-3132.

Sincerely,

Stephen R. Spencer
Regional Environmental Officer

Letter #4 (cont'd): United States Department of the Interior (USDOI)

cc: U.S. Environmental Protection Agency, Dallas, TX
Attn: Barbara Keeler
NOAA's National Marine Fisheries Service, Baton Rouge, LA
Attn: Mr. Richard Hartman
Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA
Attn: Mr. Kyle Balkum
Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge, LA
Louisiana Office of Coastal Protection and Restoration, Baton Rouge, LA
Attn: Renee Sanders

Letter #5: National Marine Fisheries Service (NMFS)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

July 1, 2010 F/SER46/RH:jk
225/389-0508

Ms. Joan M. Exnicios, Chief
Environmental Planning and Compliance Branch
Planning, Programs, and Management Division
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the Pre-Decisional Draft Integrated Feasibility Study and Supplemental Environmental Impact Statement (SEIS) for the Louisiana Coastal Area Amite River Diversion Canal (ARDC) Modification Project, Ascension and Livingston Parishes, Louisiana. The document was transmitted for NMFS' review by letter dated May 21, 2010 from the Army Corps of Engineers, New Orleans District (NOD). The NOD's letter indicates that submittal of the document to NMFS initiates essential fish habitat (EFH) consultation as required by provisions of the Magnuson-Stevens Fishery Conservation and Management Act. It should be noted that initiation of consultation under provisions of the Magnuson-Stevens Fishery Conservation and Management Act is unnecessary as the project is neither located in an area categorized as EFH or projected to have an adverse impact on EFH.

The overall study area is located in Ascension and Livingston Parishes near Head of Island, Louisiana. The tentatively selected plan (Alternative 33) calls for excavation of three created earthen-bank openings and three bifurcated conveyance channels in the north bank of the ARDC. Dredged material from the bank openings and the conveyance channels would be side-cast in alternating berms so sheet flow is not reduced. One cut would be created in the railroad grade, approximately 0.9 mile north of the ARDC, to improve sheet flow. Vegetative planting of bottomland hardwood/freshwater swamp tree species is planned on 5.0 acres of dredged material berms. Vegetative plantings of freshwater swamp tree species is planned within 438 acres of swamp floor. The proposed action would restore more than 1,600 acres of freshwater swamp habitat, create 5.0 acres of bottomland hardwood habitat, and establish hydrologic connectivity between the ARDC and western Maurepas Swamp. The project is estimated to create 679 Average Annual Habitat Units, promote germination and survival of bald cypress and other tree species, and improve biological productivity.

The enclosed comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.). Related correspondence should be directed to the

Letter #5 (cont'd): National Marine Fisheries Service (NMFS)

attention of Mr. Richard Hartman at the NMFS Southeast Region, Habitat Conservation Division office at: c/o LSU, Baton Rouge, Louisiana 70803-7535. He may be contacted by telephone at (225) 389-0508, ext. 203 or by e-mail at richard.hartman@noaa.gov.

Sincerely,

Miles M. Croom

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

cc:
FWS, Lafayette, Walther
EPA, Dallas, Ettinger
LA DNR, Consistency, Ducote
F/SER46, Swafford
F/SER4, Dale
NOAA PPI, Reid
Files

Letter #5 (cont'd): National Marine Fisheries Service (NMFS)

National Marine Fisheries Service Comments on the Draft
Supplemental Environmental Impact Statement
For the Louisiana Coastal Area (LCA)
Amite River Diversion Canal (ARDC) Modification Element of the Section 7006(E)(3)
Ecosystem Restoration Projects Study, Ascension and Livingston Parishes, Louisiana
Authorized under the 2007 Water Resources Development Act

General comments

The information presented in the Supplemental Environmental Impact Statement (SEIS) supports the determination that the Tentatively Selected Plan (TSP) is environmentally acceptable and would promote the long-term recovery and health of one of Louisiana's largest tracts of freshwater swamp and a major ecological component of the Lake Pontchartrain basin. Best management practices, environmental monitoring, and adaptive management as needed to protect fish and wildlife resources are specified in the SEIS. These measures should be retained as essential project components.

Without long term protection of the restored bald cypress-tupelo swamp, the stated objectives and benefits of the TSP may not be attained. Although the SEIS frequently mentions conservation easements will be included in the TSP, there is no assurance the easements will be sufficient to preclude timber harvest and other environmental damage. The final SEIS should be modified to stress the importance of effective conservation easements and to indicate any benefits derived from the project would be eliminated if timber harvest were allowed to occur.

Specific comments

SECTION 2.0 NEED FOR AND OBJECTIVES OF ACTION
2.3 Problems, Needs, and Opportunities
2.3.4 Effects

Page 2-15, lines 486-490 This section should explain how biomass production of herbaceous plants has increased in a severely nutrient-limited environment. Also, the section should be revised to state that biomass production has increased based on data from nutrient monitoring stations rather than "by nutrient augmentation at monitoring stations."

Page 2-15, lines 520-525 The statement: "The existing levels of productivity in the western Maurepas Swamp are as low as 50 percent or even 25 percent of average values compared to swamps that are managed or have more favorable hydrology." is confusing and needs clarification.

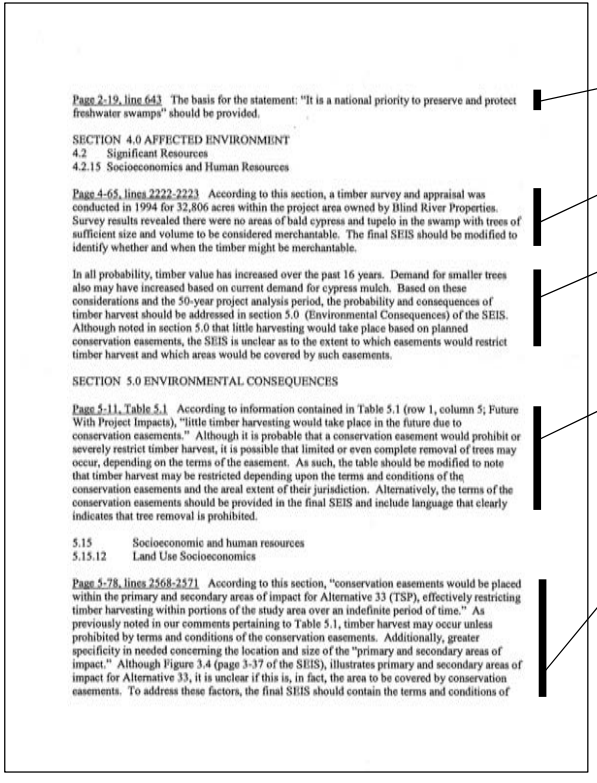
Page 2-16, line 536 NMFS suggests changing "lost to mortality and disease" to "lost to disease and other causes". We presume that "lost" and "mortality" are the same.

NMFSNO2-1: The referenced statement is qualified by stating that the monitoring station is located outside of the LCA-ARDC study area. Therefore it is not subject to the problems occurring within the LCA-ARDC study area, such as impoundment, lack of hydrologic connectivity, and a lack of nutrient input. The referenced statement was modified in Section 2.3.4.2 as follows: *"However, biomass production of herbaceous vegetation has been significantly enhanced (approximately 33 percent) by nutrient augmentation based on data from monitoring stations located within the western Maurepas Swamp, but outside of the study area."*

NMFSNO2-2: The referenced statement was reworded in Section 2.3.4.3 as follows: *"The existing levels of productivity in the western Maurepas Swamp are as low as 50 to 25 percent of average values found within swamps that are managed or have more favorable hydrology, and /or receive nutrient enrichment (Hamilton and Shaffer, 2001)."*

NMFSNO2-3: The requested change was made to the referenced statement.

Letter #5 (cont'd): National Marine Fisheries Service (NMFS)



Page 2-19, line 643 The basis for the statement: "It is a national priority to preserve and protect freshwater swamps" should be provided.

SECTION 4.0 AFFECTED ENVIRONMENT
4.2 Significant Resources
4.2.15 Socioeconomics and Human Resources

Page 4-65, lines 2222-2223 According to this section, a timber survey and appraisal was conducted in 1994 for 32,806 acres within the project area owned by Blind River Properties. Survey results revealed there were no areas of bald cypress and tupelo in the swamp with trees of sufficient size and volume to be considered merchantable. The final SEIS should be modified to identify whether and when the timber might be merchantable.

In all probability, timber value has increased over the past 16 years. Demand for smaller trees also may have increased based on current demand for cypress mulch. Based on these considerations and the 50-year project analysis period, the probability and consequences of timber harvest should be addressed in section 5.0 (Environmental Consequences) of the SEIS. Although noted in section 5.0 that little harvesting would take place based on planned conservation easements, the SEIS is unclear as to the extent to which easements would restrict timber harvest and which areas would be covered by such easements.

SECTION 5.0 ENVIRONMENTAL CONSEQUENCES

Page 5-11, Table 5.1 According to information contained in Table 5.1 (row 1, column 5; Future With Project Impacts), "little timber harvesting would take place in the future due to conservation easements." Although it is probable that a conservation easement would prohibit or severely restrict timber harvest, it is possible that limited or even complete removal of trees may occur, depending on the terms of the easement. As such, the table should be modified to note that timber harvest may be restricted depending upon the terms and conditions of the conservation easements and the areal extent of their jurisdiction. Alternatively, the terms of the conservation easements should be provided in the final SEIS and include language that clearly indicates that tree removal is prohibited.

5.15 Socioeconomic and human resources
5.15.12 Land Use Socioeconomics

Page 5-78, lines 2568-2571 According to this section, "conservation easements would be placed within the primary and secondary areas of impact for Alternative 33 (TSP), effectively restricting timber harvesting within portions of the study area over an indefinite period of time." As previously noted in our comments pertaining to Table 5.1, timber harvest may occur unless prohibited by terms and conditions of the conservation easements. Additionally, greater specificity in needed concerning the location and size of the "primary and secondary areas of impact." Although Figure 3.4 (page 3-37 of the SEIS), illustrates primary and secondary areas of impact for Alternative 33, it is unclear if this is, in fact, the area to be covered by conservation easements. To address these factors, the final SEIS should contain the terms and conditions of

NMFSNO2-4: The referenced statement was updated in Section 2.3.4.5 in Volume II of the report as follows: *Based on the findings of the 2004 LCA report, preserving and protecting freshwater swamp habitat is of national significance.*

NMFSNO2-5: The following statement was added to Section 5.15.12.2.1 in Volume II of the report: *It is anticipated that timber resources within the study area would not reach merchantable size over the fifty-year period of analysis.*

NMFSNO2-6: The language describing the restrictions stipulated by Flowage and Depositional, and Wetland Creation easements is found in the Real Estate Report in Appendix J. Statements will be added to Section 5 of the report referring to the Real Estate Report in Appendix J. Additionally, all references to "Conservation Easements" will be changed to identify the easements with the names specified in Appendix J.

NMFSNO2-7: The language describing the restrictions stipulated by Flowage and Depositional, and Wetland Creation easements is found in the Real Estate Report in Appendix J. Statements will be added to Section 5 and Table 5.1 of the report referring to the Real Estate Report in Appendix J. Additionally, all references to "Conservation Easements" will be changed to identify the easements with the names specified in Appendix J.

NMFSNO2-8: The language describing the restrictions stipulated by Flowage and Depositional, and Wetland Creation easements is found in the Real Estate Report in Appendix J. Statements will be added to Section 5 and Table 5.1 of the report referring to the Real Estate Report in Appendix J. Additionally, all references to "Conservation Easements" will be changed to identify the easements with the names specified in Appendix J.

Letter #5 (cont'd): National Marine Fisheries Service (NMFS)

any existing or planned conservation easements and should clearly describe, via narration and map, the areas that would be covered by such easements. Unless the planned bald cypress-tupelo forest can be restored and maintained over the life of the project, the desired objectives and predicted benefits may not be attained. This should be noted in the final SEIS.

Because of the importance of conservation easements with regard to protecting and restoring fish and wildlife habitat, the final SEIS should note that NMFS and other federal and state resource agencies will be, or have been, consulted during development of the terms and conditions and determination of the location and areal extent of the conservation easement(s).

Finally, the possibility that tree planting and project related extension of dry periods (to promote seed germination) could actually encourage timber harvest should be addressed in the final SEIS.

SECTION 8.0 CONCLUSIONS AND DETERMINATIONS

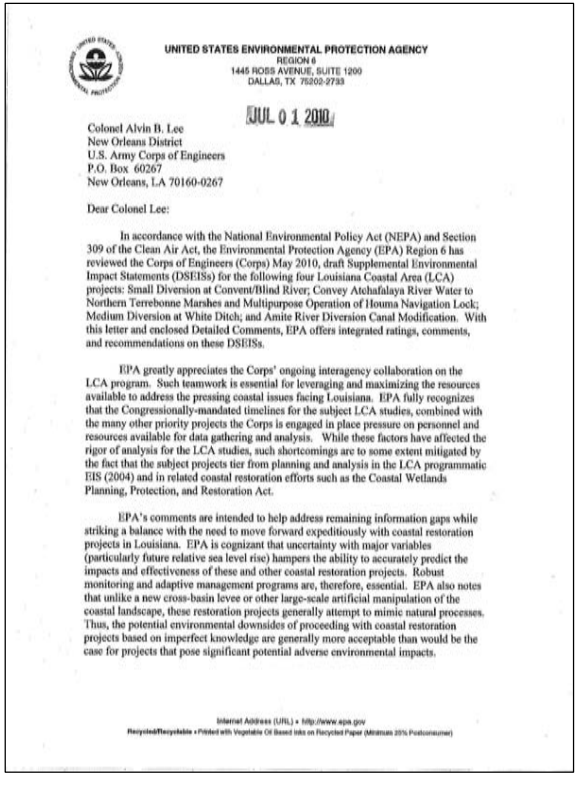
8.2 Recommended Plan

Page 8-1, line 43 NMFS recommends changing "Easements on 1,633 acres of land" to "Conservation easements on 1,633 acres of land." Also, as previously noted, the final SEIS should be clear concerning the location and size (acreage) of areas to be protected by conservation easements. In this regard, clarification is needed as to location of the 1,633 acre area mentioned.

NMFSNO2-9: The purpose of the easements is to prevent timber harvesting activities which will negatively impact this aspect of socioeconomics within the areas of impact. The language describing the restrictions stipulated by Flowage, Depositional, and Wetland Creation easements found in the Real Estate Report in Appendix J. Statements will be added to Section 5 of the report referring to the Real Estate Report in Appendix J. Additional discussion will also be added to Section 5 and Table 5.1 stipulating that easements will be in place, thereby restricting timber harvesting.

NMFSNO2-10: The language describing the restrictions stipulated by Flowage, Depositional, and Wetland Creation easements is found in the Real Estate Report in Appendix J. All references to "Conservation Easements" will be changed to identify the easements with the names specified in Appendix J.

Letter #6: Environmental Protection Agency (EPA)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

JUL 0 1 2010

Colonel Alvin B. Lee
New Orleans District
U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Dear Colonel Lee:

In accordance with the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency (EPA) Region 6 has reviewed the Corps of Engineers (Corps) May 2010, draft Supplemental Environmental Impact Statements (DSEISs) for the following four Louisiana Coastal Area (LCA) projects: Small Diversion at Convent/Blind River; Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock; Medium Diversion at White Ditch; and Amite River Diversion Canal Modification. With this letter and enclosed Detailed Comments, EPA offers integrated ratings, comments, and recommendations on these DSEISs.

EPA greatly appreciates the Corps' ongoing interagency collaboration on the LCA program. Such teamwork is essential for leveraging and maximizing the resources available to address the pressing coastal issues facing Louisiana. EPA fully recognizes that the Congressionally-mandated timelines for the subject LCA studies, combined with the many other priority projects the Corps is engaged in place pressure on personnel and resources available for data gathering and analysis. While these factors have affected the rigor of analysis for the LCA studies, such shortcomings are to some extent mitigated by the fact that the subject projects tier from planning and analysis in the LCA programmatic EIS (2004) and in related coastal restoration efforts such as the Coastal Wetlands Planning, Protection, and Restoration Act.

EPA's comments are intended to help address remaining information gaps while striking a balance with the need to move forward expeditiously with coastal restoration projects in Louisiana. EPA is cognizant that uncertainty with major variables (particularly future relative sea level rise) hampers the ability to accurately predict the impacts and effectiveness of these and other coastal restoration projects. Robust monitoring and adaptive management programs are, therefore, essential. EPA also notes that unlike a new cross-basin levee or other large-scale artificial manipulation of the coastal landscape, these restoration projects generally attempt to mimic natural processes. Thus, the potential environmental downsides of proceeding with coastal restoration projects based on imperfect knowledge are generally more acceptable than would be the case for projects that pose significant potential adverse environmental impacts.

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Letter #6 (cont'd): Environmental Protection Agency (EPA)

EPA Region 6 rates the four DSEISs as follows:

- **Small Diversion at Convent/Blind River: "EC-2".** (EPA has environmental concerns and requests additional information in the Final Supplemental Environmental Impact Statement.)
- **Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock: "EC-2".** (EPA has environmental concerns and requests additional information in the Final Supplemental Environmental Impact Statement.)
- **Medium Diversion at White Ditch: "EC-2".** (EPA has environmental concerns and requests additional information in the Final Supplemental Environmental Impact Statement.)
- **Amite River Diversion Canal Modification: "LO".** (EPA's review has no objections and has not identified any potential environmental impacts requiring substantive changes to the preferred alternative.)

EPA continues to support the LCA program as an important step toward greater efforts to restore some semblance of sustainability to parts of coastal Louisiana. To that end, it is important to reiterate that the LCA program in general and these projects in particular represent near-term measures, and should not be mistaken for the larger and more comprehensive effort needed to address coastal wetland loss in Louisiana on the scale and scope warranted. The ongoing oil spill in the Gulf of Mexico and its impacts on Louisiana's valuable coastal wetlands and aquatic resources only underscore this point. Nevertheless, these and other LCA projects can be viewed as stepping stones toward larger and more aggressive projects, and offer valuable learning and adaptive management opportunities that will help in that regard.

The proposed White Ditch project represents the largest and most ambitious use of seasonal, high-river "pulsing" as a technique to increase the environmental benefits of diversions, while reducing potential impacts to existing fisheries. Of the four LCA projects discussed herein, the White Ditch diversion offers the greatest promise for coastal restoration benefits and advancing larger-scale projects. EPA also notes that the Amite River diversion canal gapping project and the proposed Convent/Blind River diversion are not mutually exclusive and could work in concert with the proposed LCA Hope Canal diversion. Although the Blind River/Convent diversion is further along in the NEPA process than Hope Canal, the latter offers a superior opportunity to address ecosystem needs in the Maurepas Swamp. Again, while these projects are not mutually exclusive, EPA encourages expedited implementation of the Hope Canal diversion. Finally, given the relatively high cost to environmental benefit ratio, EPA would not place a high priority on implementation of the Atchafalaya River conveyance project over other LCA restoration projects, such as White Ditch.

Letter #6 (cont'd): Environmental Protection Agency (EPA)

EPA appreciates that the Corps recognizes the need to monitor the extent to which the ongoing oil spill could affect study areas and aquatic resources covered by these four projects. It currently appears unlikely that the oil spill would directly affect the two proposed projects in the Maurepas Swamp, but the study areas for the other two projects have already or could be impacted by the spill. Accordingly, the Corps needs to be prepared to modify and/or further expedite such projects as needed, and perform supplemental environmental analysis where warranted.

The schedule and resource constraints discussed earlier have also affected EPA's ability to fully engage in the interagency development and review of these four LCA projects. EPA greatly respects the views of our state and Federal partner agencies with responsibilities and expertise pertaining to fish and wildlife impacts. EPA will defer to some extent to the recommendations of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Louisiana Department of Wildlife and Fisheries on any additional information and analysis needed for resources within their purview. EPA encourages the Corps to fully address any such needs identified by these agencies.

Moving forward, we would also point out the connection between the ongoing LCA effort to develop near-term restoration projects and the interagency effort to prioritize and expedite coastal restoration projects pursuant to the March 2010, Roadmap for Restoring Ecosystem Resiliency and Sustainability (Roadmap). The interagency process initiated by the Roadmap provides a valuable opportunity to identify the most promising LCA projects and focus limited resources to ensure that such projects are constructed in a timely fashion.

EPA appreciates the opportunity to review the DSEIS's. If you have any questions about the 309 Review Process, please contact Michael Jansky of my staff at (214) 665-7451 or by e-mail at jansky.michael@epa.gov. If you questions or wish to discuss the technical aspects of our comments, contact John Ettinger at (504) 862-1119. Please send our office two copies of the Final SEIS when it is sent to the Office of Federal Activities, EPA (Mail Code 2252A), Ariel Rios Building, 1200 Pennsylvania Ave, N.W., Washington, D.C. 20460.

Sincerely yours,

Cathy Gilmore

Cathy Gilmore, Chief
Office of Planning
and Coordination 6ENXP

Enclosure

Letter #6 (cont'd): Environmental Protection Agency (EPA)

DETAILED COMMENTS

ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENTS FOR THE SMALL DIVERSION AT CONVENT/BLIND RIVER; CONVEY ATCHAFALAYA RIVER WATER TO NORTHERN TERREBONNE MARSHES AND MULTIPURPOSE OPERATION OF HOUMA NAVIGATION LOCK; MEDIUM DIVERSION AT WHITE DITCH, AND AMITE RIVER DIVERSION CANAL MODIFICATIONS FOR THE LOUISIANA COASTAL AREA

COMMENTS

1. Small Diversion at Convent/Blind River DSEIS, May 2010

In general, additional freshwater and sediments to Maurepas Swamp provided by the proposed diversion is positive for the swamp. A potential downside to diverting existing surface waters and sediments is pollutants in the diverted water could impact the Blind River and Lake Maurepas. While such concerns are manageable, EPA would recommend additional information and analysis pertaining to water quality.

The 2001 Diversion into the Maurepas Swamps study by Lee Wilson & Associates, as well as Batelle's Assessments of Ecological Risks of Contaminants from a Proposed Reintroduction of Mississippi River Water into Maurepas Swamp (Phase I and II, 2005 and 2008, respectively), are cited as support that long term adverse impacts to water quality in the Maurepas Swamp, the Blind River, and Lake Maurepas are not anticipated. Unfortunately, the study area for these documents appears limited to the LCA Small Diversion at Hope Canal project area. While these assumptions may be applicable to a single 1500 cfs diversion, the application of these assumptions to a project diverting twice the amount of water (as in Small Diversion at Convent/Blind River) must account for the difference in scope. EPA notes, however, that if the diverted water flows through the swamp rather than directly to the Blind River and Lake Maurepas, and if the area of swamp is sufficient to reduce pollutants adequately, then this may not be a significant concern.

The LCA Ecosystem Restoration Study Programmatic EIS (2004) recognizes these concerns and suggests that the LCA Plan needs to consider other activities, initiate an aggressive coordination plan with the stakeholders involved, and ensure that all activities including the LCA Plan complement each other. EPA recommends that use of studies for support of these projects acknowledge the limitations and applicability. Additionally, it is suggested that cumulative effects determinations clarify if the assumptions stated are applicable to an existing baseline with no Maurepas Swamp projects other than the single proposed project, or that the cumulative effect includes the additive effects of all related Maurepas Swamp projects.

Letter #6 (cont'd): Environmental Protection Agency (EPA)

There is likely continued interest on the part of some landowners to log cypress in the Maurepas Swamp. Given the degraded state of the swamp throughout much of this area, there is a high risk that any such logging would be unsustainable. Such logging could conflict with or undermine this and other proposed restoration efforts for the Maurepas Swamp. Accordingly, this project should include as a non-structural measure a commitment to full and effective enforcement of Clean Water Act Section 404 and/or Section 10 of the Rivers and Harbors Act as such laws pertain to logging, particularly where unsustainable.

The ongoing Corps of Engineers West Shore Lake Pontchartrain Hurricane Protection Study is reviewing different levee alignments in the vicinity of this proposed project. At least one of these levee alignments ("Alignment D") would further enclose the cypress swamp that would be benefited by this proposed diversion. There is no discussion of how these two projects would or would not work in concert to achieve the desired ecosystem restoration goals. EPA is concerned that levee alignments which enclose wetlands can result in significant direct, indirect, and cumulative adverse ecological impacts that would be contrary to the LCA Plan in general and this project in particular. The supplemental EIS should explain how any such levee work would be coordinated with the proposed for Convent/Blind River diversion, such that the former does not conflict with or undermine the latter.

Specific comments:

a. It is understood that the Romeville diversion (Alt 2) is the preferred alternative and if implemented will use existing St. James Parish drainage canals. Insufficient data is available to determine if this design addresses the concerns raised in the 2001 Lee Wilson report on Diversions into the Maurepas Swamps regarding diverted Mississippi River water reaching the Blind River directly with most diverted water directly delivered to Lake Maurepas as result. EPA recommends hydrologic modeling efforts to better identify/quantify how water (sediment and nutrients) moves through the system and within each hydrologic unit under the proposed operation plan along with determination of water levels and swamp flood elevations on a refined scale to be incorporated into the hydrologic modeling. Similar comments have been made by the United States Fish and Wildlife Service (USFWS) in its draft Fish and Wildlife Coordination Act report.

b. Page 4-32 through 4-27: Water Quality Concerns – Tables of water quality information do not provide adequate information to support decisions of environmental consequences i.e., data over ten years old suggests that Blind River has levels of copper where mean value is both acutely and chronically toxic to aquatic life. However, no 303(d) listing noted currently. EPA recommends that analytical data be appropriately annotated as to location of monitoring point, hardness of water at that monitoring point and applicable hardness dependent criteria at that point. Also note if analysis yielded total or dissolved pollutant.

Letter #6 (cont'd): Environmental Protection Agency (EPA)

c. Pages 4-32: Water Quality Concerns - Descriptions of conditions for Lower Mississippi River found on Page 4-32 suggest that volatile organic carbon (VOC) analysis was performed. Data is not presented nor is an explanation of results provided.

d. Page 4-32 : Water Quality Concerns - According to the DSEIS, the LDEQ 2006 Integrated Report both the Primary Contact Recreation (PCR) and Secondary Contact Recreation (SCR) designated uses were fully supported, while Fish and Wildlife Propagation (FWP) and Outstanding Natural Resource (ONR) uses are not supported. The suspected causes of impairment for the FWP designated use were mercury, nitrate/nitrite, non-native aquatic plants, total phosphorus (TP), and turbidity. The suspected sources for mercury were listed as atmospheric deposition and unknown sources. Site clearance (land development or redevelopment) and flow alterations from water diversions were listed as the suspected sources for nitrate/nitrite, dissolved oxygen (DO), and TP. The suspected causes of impairment for the ONR designated use were sedimentation/siltation and turbidity, which are believed to be caused by site clearance.

(1) In light of these impairments, the SEIS should more clearly describe the impacts on the Blind River from diverted Mississippi River water through the swamp and thus to the River. In light of an annual estimate of sediment load to Blind River and Maurepas Swamp of approximately 505,000,000 kg/yr (Page 5-51, Line 2) discuss how sediment loading in return flows (throughput from swamp to River) could affect water quality in the study area. Here again, hydrology is key with respect to such issues. Work on the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Maurepas Diversion project suggests that if the diversion is routed through a swamp receiving area of sufficient size virtually all sediment will be deposited in the swamp.

(2) Page 3-104, Line 28 and Appendix I: In light of current mercury impairments in the Blind River and mercury levels in diverted Mississippi River water, the SEIS should more clearly describe additional mercury loading and methylation risks to the swamp as well as to the Blind River and Lake Maurepaus. Appendix I (Adaptive Management and Monitoring Plan)(Page 10) and DSEIS suggest nutrients are a risk (Page 3-104, Line 28); however, mercury is not mentioned as a risk. EPA recommends periodic monitoring for mercury increases in swamp (sediments, fish tissue) or receiving waters (Blind River/Lake Maurepaus; sediments, fish tissue), along with consideration of what/if any impacts to aquatic life, migratory birds and listed species might be associated with such water quality issues. (Battelle. 2007. Limited Phase II Assessment of Ecological Risks of Contaminants from a Proposed Reintroduction of Mississippi River Water into Maurepas Swamp. Report from EPA Region 6. EPA Contract No. 68-C-03-041, Work Assignment No 4-40.)

Letter #6 (cont'd): Environmental Protection Agency (EPA)

(3) Page 3-104, Line 28 and Appendix I: In light of current metals water column levels in the Blind River and metals levels in diverted Mississippi River water, the SEIS should more clearly describe additional metals loading risks to the swamp as well as to the Blind River and Lake Maurepaus. Appendix I (Adaptive Management and Monitoring Plan)(Page 10) and draft SEIS suggest nutrients are a risk (Page 3-104, Line 28); however, metals not mentioned as a risk . EPA recommends monitoring for metals increases in swamp (sediments, fish tissue).

e. Page 3-102, Line 3-102 and Appendix I: Objectives stated in DEIS on Page 3-102 (beginning at Line 34) and Appendix I (page 10) are not in sync. Ensure that monitoring design supports objective. For example, Objective 1 (EIS) suggests decreases in nitrogen and phosphorus and DO increases but has no monitoring design associated. Objective 1 (Appendix I) does not include water quality at all. Recommend a separate objective for water quality or include as a risk with monitoring design.

f. Page 4-36, Line 10: States **4.2.3.2 Blind River and Maurepaus Swamp.** See no information on the swamp.

g. Page 3 – 37, Line 17: blind river should be revised to Blind River.

h. Page 3-16, Table 3-1: Comments for TS-3 to TS-6 are wrong. Comments column narrative needs to shift down.

i. Beginning at Page 5-1, **5 Environmental Consequences**: Ensure continuity throughout this section regarding the complimentary projects of Hope Canal and Amite River Canal Diversions. The Hope Canal project is typically discussed in the "no action" alternative. Studies have been performed on the concept of a 1500 cubic feet per second (cfs) diversion impacts to the swamp (as part of the Maurepas Diversion project under the CWPPRA program), the Blind River and Lake Maurepas. Ensure that implications of these studies are applicable to the Convent/Blind Diversion, since this preferred alternative is for a proposed diversion of 3000 cfs.

j. Readability would be enhanced if the document would spell out the meaning of acronyms upon first usage, i.e., ADCIRC, PCR, SCR, and ONR.

2. Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock DSEIS, May 2010

WRDA 2007 included authorization for feasibility-level reports of six of the ten near-term elements in the 2004 LCA Report. Two of those six elements were determined to be hydrologically intertwined and the planning efforts were subsequently combined. Consequently, the projects known as Convey Atchafalaya to Northern Terrebonne Marsh and Multipurpose

Letter #6 (cont'd): Environmental Protection Agency (EPA)

Operation of the Houma Navigation Lock were integrated into the Pre-Decisional Draft Integrated Feasibility Study and EIS for the Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock (LCA ARTM/MOHNL Project) and it is the later document, published in May 2010, to which these comments apply.

The objective of the project is to provide additional freshwater, nutrients, and sediments to the wetland communities of northwestern Terrebonne Basin, both north and south of the Gulf Intracoastal Waterway, which have exhibited accelerated wetland loss and ecosystem deterioration due to altered hydrology, reduced sediment and nutrient deposition, saltwater intrusion, tidally forced erosion, and subsidence. Currently, net primary productivity is declining and land loss is increasing, with existing fragmented emergent wetlands converting to shallow open water. According to United States Geological Survey (USGS) analyses, the overall rate of land loss in this area is 2,597 acres/year, or approximately 0.3 percent per year. If current conditions persist, it is predicted that 102,000 acres (18%) of remaining wetlands would decline over the next 50 years. Even more dramatic losses would be expected within several of the study subunits, with the loss of all emergent wetlands within the next 50 years.

As part of the feasibility study, multiple alternatives were developed incorporating a large array of treatment measures to be applied over the 1,100 square mile study area. The resulting Tentatively Selected Plan (TSP) is predicted to reduce the loss of 9,655 acres of marsh habitat (3,220 average annual habitat units (AAHUs)) at a cost of $311,030,000, including monitoring and adaptive management costs.

Of the alternatives studied, Alternative 2 is identified by the Corps and the interagency team as the TSP and it is also identified as the National Ecosystem Restoration Plan (NER). TSP fits the cost limitations of WRDA 2007 and is the most efficient plan from an incremental cost per average annualized habitat unit (AAHU) perspective. The TSP/NER plan involves construction of 56 structures and other water management features, as well as the opportunistic operation of the Houma Navigation Canal (HNC) Lock Complex, in an effort to address holistically the declining health of the Terrebonne marsh ecosystem, while meeting the planning objectives.

EPA supports the rationale provided for defining the NER plan and EPA further support the selection of Alternative 2 as the TSP. EPA does so in light of the urgency of addressing dramatic wetland habitat loss and degradation in the study area, while recognizing that there are a number of technical and design uncertainties yet to be worked through. The tight schedule under which this DSEIS was prepared resulted in publication of the document before all planning evaluations have been completed. While EPA believes this work should be completed prior to final plan approval, EPA does not believe that these analyses will alter the alternatives ranking. Therefore, EPA recommends that final approval of the TSP/NER plan be conditioned upon

Letter #6 (cont'd): Environmental Protection Agency (EPA)

completion of additional modeling and hydrology work needed prior to final project design and implementation of the plan. See the USFWS's May 2010 Draft Fish and Wildlife Coordination Act Report for details (Vol. III, Appendix B, pages 47-49).

EPA's support for the TSP is also predicated on the potential for adaptively responding to continually refined data, according to the management and monitoring plan (Vol. III, Appendix I). The incorporation of a monitoring plan and the commitment to adaptive management is a vital component for dealing with the uncertainties associated with the ecosystem modeling and for coordinating this project with other planned and future restoration and storm damage risk reduction projects in the area.

While this plan represents a valuable contribution to reducing the ecosystem degradation in the study area, a sustainable and resilient coastal ecosystem will quite likely require additional hydrologic manipulations. It is unlikely that this project alone will result in a sustainable ecosystem. The project features will not actively introduce additional sediment, nutrients, and freshwater from other sources. It will instead redistribute and more efficiently utilize existing freshwater within the system.

With that frame of reference, the project cost of $311,030,000 deserves careful consideration. Although the benefit area of the project is large and the ecosystem values to the nation are great, the cost is high and the benefits are incremental. These first cost benefits to the nation will only be realized if a future commitment is made to augment this project with additional hydrologic manipulations at a landscape scale.

This point cannot be overemphasized. As noted in the report, "[t]he project area is declining and imperiled. While the project cannot stop the natural processes of sea level rise, subsidence, and storm-caused erosion, the project can greatly slow down the disappearance of these landforms by decreasing the rate of decline of wetland habitat in the coastal system" (Vol. I, page 4-61).

Relative sea level rise (RSLR) evaluation curves were developed for three different sea level rise scenarios. The TSP/NER plan would provide benefits under the low and the intermediate RSLR scenarios. However, at the high RSLR rate, "marsh collapse is predicted to begin in 2017, when RSLR rate reaches 10 mm/yr. This rate represents a threshold believed to initiate rapid marsh collapse." None of the alternatives would prevent marsh collapse at the high RSLR rate. Once again, this is a large investment for benefits which will require additional treatment efforts to insure sustainability beyond the next seven years. This is too large an investment not to be part of a comprehensive plan of attack.

This project holds the promise of reducing additional wetland losses by some 9,655 acres. That is a far different scenario than "resulting in a net gain of 9,655 acres," as cited in various

Letter #6 (cont'd): Environmental Protection Agency (EPA)

sections throughout the reports, in both Volumes I and III. This is a significant correction which should be made in the Final EIS.

The correction should start at the top, with Objective 1: "Prevent, reduce, and/or reverse future wetland loss" and Objective 2: "Achieve and maintain characteristics of sustainable marsh hydrology." These goals are worthy of a more comprehensive approach with a larger scope than this near term project affords. As stated in the reports, the desired outcome seems to stop short of the objectives by establishing a measure of "reducing the rate of land loss compared to the pre-project condition." These outcomes appear to be achievable but they do not line up well with the more aggressive objectives. This is also a significant correction which should be made in the Final EIS.

Perhaps another project objective should be to optimize delta building, or at least to avoid negatively impacting ongoing Atchafalaya Delta building processes. The Atchafalaya River is building the only two actively growing deltas on the Louisiana coast. Although these active deltas are growing, they have not offset the land loss in this basin. However, they represent part of the ecosystem that is functioning in a positive trend and that should be valued and protected.

One of the more notable project uncertainties involves the construction and operation of the HNC lock complex for environmental purposes after the year 2025. The HNC lock complex is a feature of the Morganza to the Gulf project. If the lock complex is not constructed or if it is not operated as envisioned by this project, all benefits attributed to that feature will be unrealized. Accordingly, the Final EIS should provide an analysis of benefits (including the calculation of a benefit/cost ratio) both with and without the implementation of this feature.

The Final SEIS should clarify the implications for this project of the Corps' ongoing study to deepen the HNC channel. Also, the Final should clarify the lock closure conditions which were analyzed. In various sections of Volume III, those conditions are reported to include periods when the sector gates would not be closed, while other references infer that the modeling assumed constant closure. Finally, the Final SEIS should provide a plan for operating the sluice gates and it should explain how that operation would be anticipated to impact basin hydrology and consequent ecosystem health and sustainability.

Another area for further consideration involves statements in both Volumes I and III that the floating marshes in the upper Penchant Basin are currently stable and experiencing conditions where sufficient freshwater, nutrient, and sediment loads are being provided. Without further documentation, this conclusion would seem to overstate the current condition of these marshes. At a minimum, the vulnerability of these fragile marshes should be taken into account in the project planning. Based on a study conducted for EPA (Floating Marshes in the Barataria and Terrebonne Basins, Louisiana, Sept. 1994, Charles E. Sasser et al. (LSU-CEI-94-02)), notable changes to these marshes have occurred over the last several decades.

Letter #6 (cont'd): Environmental Protection Agency (EPA)

Six of the study sites in the Louisiana State University (LSU) project lie within the LCA ARTM/MOHNL Project study area. Based on habitat mapping and the results of other work by the same researchers, some floating marsh habitats have changed over the last several decades from one type of flotant to another type, or to open water. In the northern Terrebonne basin and upper Bayou Penchant basin, large areas of formerly *Panicum hemitomon* thick-mat flotant marsh converted to thin-mat *Eleocharis* flotant marshes or to open water. While much remains unknown as to what processes have operated on these areas to produce such dramatically different results, possible contributors include: altered hydrology due to canal construction and dredging; flux of organic material from the marsh due to hydrologic changes; nutria herbivory; nutrient dynamics due to altered hydrology; burning; and floods/storms.

With regard to compensatory mitigation, the report states that "[t]emporary negative impacts to the marsh associated with excavation of canals and management structures will be compensated for by creation of new marsh of better quality as a result of the reintroduction of freshwater, nutrients, and sediments into the Study Area" (Vol. I, page 4-68 and Vol. III, Section 3, page 49). The more likely case is that marsh degradation will be slowed by these measures. Additional marsh creation should be considered, however, if excess dredged material is available beyond that which is required for canal bank construction. In addition, all actions identified in the Clean Water Act Section 404(b) evaluation to minimize impact should be incorporated into the final plan.

Finally, EPA suggests that, to the degree possible, the Final EIS include an updated assessment of the Deepwater Horizon oil spill impacts to the Terrebonne basin ecological resources subject to this project proposal. The baseline conditions should be modified as necessary and a projection of the potential for the TSP/NER plan, or any individual features of other alternatives, for remediating those impacts should be considered. The TSP/NEP plan should be modified if the incorporation of other features could reasonably be expected to provide incremental benefits to protect the marshes from further oil spill damage under non-storm and/or storm conditions.

As a partner with the Corps of Engineers and others in the restoration of coastal Louisiana, EPA offers these comments in an effort to promote the most effective long-term wetlands protection and restoration strategy for the study area. This near term project could provide a platform for a sustainable coastal ecosystem, when viewed in tandem with measures to provide additional inputs of sediments and flows.

3. Medium Diversion at White Ditch DSEIS, May 2010

As noted in our cover letter, EPA supports the proposed White Ditch diversion. It is consistent with our long-standing priority of re-establishing Mississippi River inputs to help undo to some extent the major disruption of deltaic processes that underlies the ongoing loss of

Letter #6 (cont'd): Environmental Protection Agency (EPA)

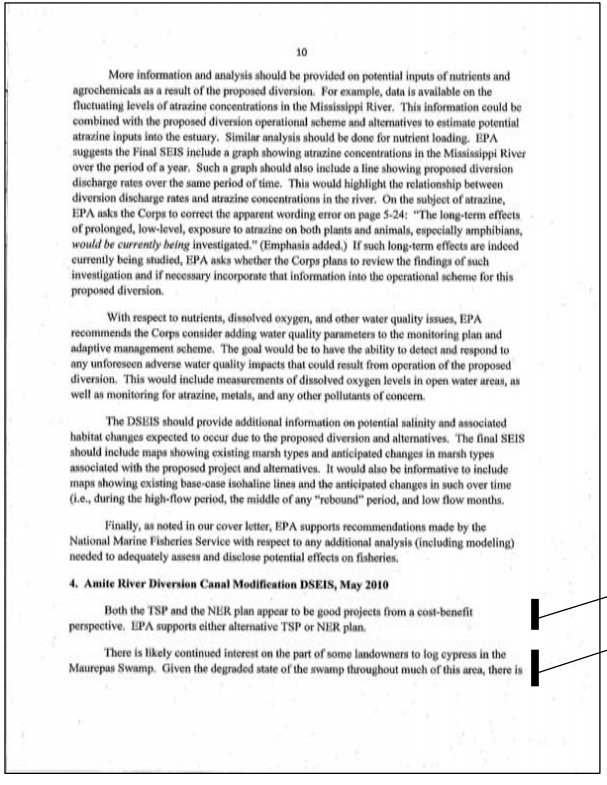
coastal wetlands in Louisiana. EPA recognizes such river diversions have the potential to alter existing fisheries in the receiving areas due to changes in salinities, nutrients, sedimentation, and other factors. However, without efforts to restore deltaic processes by reintroducing riverine inputs, the productivity of such fisheries and coastal wetlands remains gravely threatened. The cost of inaction is continued rapid decline of wetlands and the related aquatic resources in deltaic Louisiana.

Nevertheless, EPA is sensitive to the potential effects of diversions on fisheries and the livelihoods built upon them. EPA recognizes the value of minimizing impacts where practicable and consistent with the pressing and long-term need to restore some semblance of sustainability to coastal Louisiana. There appear to be restoration approaches which could mimic natural deltaic processes and possibly minimize such impacts to existing fisheries. Specifically, EPA is referring to the concept of diversion "pulsing" which is intended to mimic seasonal riverine inputs historically associated high water events on the Mississippi. Such a "pulsing" operation is proposed for the White Ditch diversion, and entails high volumes of riverine input for months when stages and sediment concentrations are relatively high, followed by relatively limited "maintenance" inputs during the remaining months. This operation scheme has the promise of increasing sediment inputs, while reducing potential disruption of fisheries.

As noted in the cover letter, the capacity to precisely predict the effects of this and other coastal restoration projects is limited by uncertainty over major variables, particularly the future rate of relative sea level rise. This puts a premium on monitoring and adaptive management. At the programmatic level, the information gained through implementation of the White Ditch diversion would help test the diversion "pulsing" concept, thereby potentially assisting the larger-scale planning necessary to address coastal land loss in Louisiana. Thus, we believe the White Ditch project has the potential to both help restore coastal wetlands in the relative near term and support comprehensive coastal restoration in the future.

EPA appreciated the Corps' efforts to consider how different relative sea level rise (RSLR) scenarios could affect projected project benefits. Certainly, the central focus of this project (increasing sediment input into coastal marsh) is of primary importance for offsetting or slowing wetland loss due to RSLR. EPA agrees that diversion alternatives that provide greater sediment inputs could provide greater wetland benefits in that regard. However, the DSEIS might overstate the ability of the tentatively selected plan to counter more extreme rates of RSLR. Specifically, the DSEIS states that the tentatively selected plan could be used to "overcome high sea level rise". Such a statement should be tempered by the recognition that such high-end RSLR estimates would represent unprecedented environmental conditions and, therefore, our ability to accurately predict marsh response to such is limited. We would also note that the aforementioned quote appears inconsistent with the statement made on page ES-11: "…no evaluated alternative is able to offset the high rate of sea-level rise."

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More information and analysis should be provided on potential inputs of nutrients and agrochemicals as a result of the proposed diversion. For example, data is available on the fluctuating levels of atrazine concentrations in the Mississippi River. This information could be combined with the proposed diversion operational scheme and alternatives to estimate potential atrazine inputs into the estuary. Similar analysis should be done for nutrient loading. EPA suggests the Final SEIS include a graph showing atrazine concentrations in the Mississippi River over the period of a year. Such a graph should also include a line showing proposed diversion discharge rates over the same period of time. This would highlight the relationship between diversion discharge rates and atrazine concentrations in the river. On the subject of atrazine, EPA asks the Corps to correct the apparent wording error on page 5-24: "The long-term effects of prolonged, low-level, exposure to atrazine on both plants and animals, especially amphibians, *would be currently being* investigated." (Emphasis added.) If such long-term effects are indeed currently being studied, EPA asks whether the Corps plans to review the findings of such investigation and if necessary incorporate that information into the operational scheme for this proposed diversion.

With respect to nutrients, dissolved oxygen, and other water quality issues, EPA recommends the Corps consider adding water quality parameters to the monitoring plan and adaptive management scheme. The goal would be to have the ability to detect and respond to any unforeseen adverse water quality impacts that could result from operation of the proposed diversion. This would include measurements of dissolved oxygen levels in open water areas, as well as monitoring for atrazine, metals, and any other pollutants of concern.

The DSEIS should provide additional information on potential salinity and associated habitat changes expected to occur due to the proposed diversion and alternatives. The final SEIS should include maps showing existing marsh types and anticipated changes in marsh types associated with the proposed project and alternatives. It would also be informative to include maps showing existing base-case isohaline lines and the anticipated changes in such over time (i.e., during the high-flow period, the middle of any "rebound" period, and low flow months.

Finally, as noted in our cover letter, EPA supports recommendations made by the National Marine Fisheries Service with respect to any additional analysis (including modeling) needed to adequately assess and disclose potential effects on fisheries.

4. Amite River Diversion Canal Modification DSEIS, May 2010

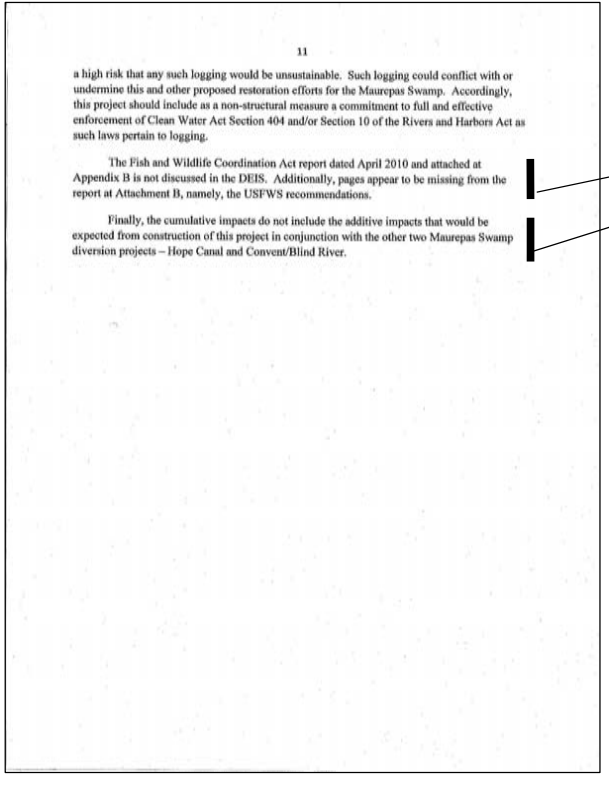
Both the TSP and the NER plan appear to be good projects from a cost-benefit perspective. EPA supports either alternative TSP or NER plan.

There is likely continued interest on the part of some landowners to log cypress in the Maurepas Swamp. Given the degraded state of the swamp throughout much of this area, there is

EPANO1-1: Supportive comment

EPANO1-2: Easements will be put into place to restrict forestry activities, as stated in Section 5 of the report. Appendix J of the report contains the Real Estate Plan which describes the easements that will be put into place for the areas of impact. In addition, Section 7 of the report stipulates that all compliance and coordination of applicable laws and restrictions that will be adhered to.

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a high risk that any such logging would be unsustainable. Such logging could conflict with or undermine this and other proposed restoration efforts for the Maurepas Swamp. Accordingly, this project should include as a non-structural measure a commitment to full and effective enforcement of Clean Water Act Section 404 and/or Section 10 of the Rivers and Harbors Act as such laws pertain to logging.

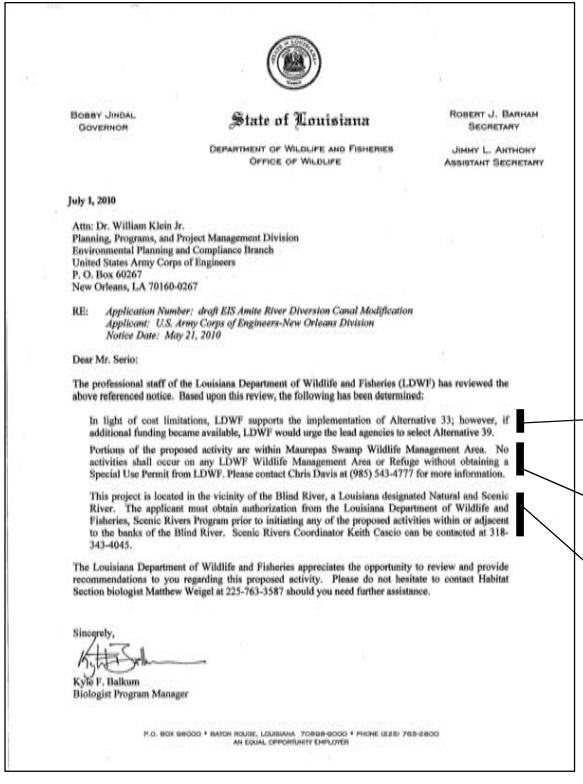
The Fish and Wildlife Coordination Act report dated April 2010 and attached at Appendix B is not discussed in the DEIS. Additionally, pages appear to be missing from the report at Attachment B, namely, the USFWS recommendations.

Finally, the cumulative impacts do not include the additive impacts that would be expected from construction of this project in conjunction with the other two Maurepas Swamp diversion projects – Hope Canal and Convent/Blind River.

EPANO1-3: The FWCAR is discussed in Section 7.2.17 in Volume II of the report. The updated version of the FWCAR will be included in all subsequent submittals.

EPANO1-4: Cumulative impacts discussions include similar restoration projects within or near the study area. These discussions are found throughout Section 5 in Volume II of the report.

Letter #7: Louisiana Department of Wildlife and Fisheries (LDWF)



BOBBY JINDAL
GOVERNOR

State of Louisiana

DEPARTMENT OF WILDLIFE AND FISHERIES
OFFICE OF WILDLIFE

ROBERT J. BARHAM
SECRETARY

JIMMY L. ANTHONY
ASSISTANT SECRETARY

July 1, 2010

Attn: Dr. William Klein Jr.
Planning, Programs, and Project Management Division
Environmental Planning and Compliance Branch
United States Army Corps of Engineers
P. O. Box 60267
New Orleans, LA 70160-0267

RE: *Application Number: draft EIS Amite River Diversion Canal Modification*
Applicant: U.S. Army Corps of Engineers-New Orleans Division
Notice Date: May 21, 2010

Dear Mr. Serio:

The professional staff of the Louisiana Department of Wildlife and Fisheries (LDWF) has reviewed the above referenced notice. Based upon this review, the following has been determined:

In light of cost limitations, LDWF supports the implementation of Alternative 33; however, if additional funding became available, LDWF would urge the lead agencies to select Alternative 39.

Portions of the proposed activity are within Maurepas Swamp Wildlife Management Area. No activities shall occur on any LDWF Wildlife Management Area or Refuge without obtaining a Special Use Permit from LDWF. Please contact Chris Davis at (985) 543-4777 for more information.

This project is located in the vicinity of the Blind River, a Louisiana designated Natural and Scenic River. The applicant must obtain authorization from the Louisiana Department of Wildlife and Fisheries, Scenic Rivers Program prior to initiating any of the proposed activities within or adjacent to the banks of the Blind River. Scenic Rivers Coordinator Keith Cascio can be contacted at 318-343-4045.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact Habitat Section biologist Matthew Weigel at 225-763-3587 should you need further assistance.

Sincerely,

Kyle F. Balkum
Biologist Program Manager

P.O. BOX 98000 • BATON ROUGE, LOUISIANA 70898-9000 • PHONE (225) 765-2800
AN EQUAL OPPORTUNITY EMPLOYER

LDWFNO1-1: The proposed action is recommended with all applicable project constraints in mind, such as the WRDA 2007 cost limit. Coordination is currently underway with Livingston Parish to utilize any potential funding received by the proposed CIAP project to restore the portions of the study area included in the NER plan, but not in the TSP.

LDWFNO1-2: The USACE has coordinated with the LDWF that the proposed action would not occur within the Maurepas WMA. Hence, a Special Use Permit would not be required.

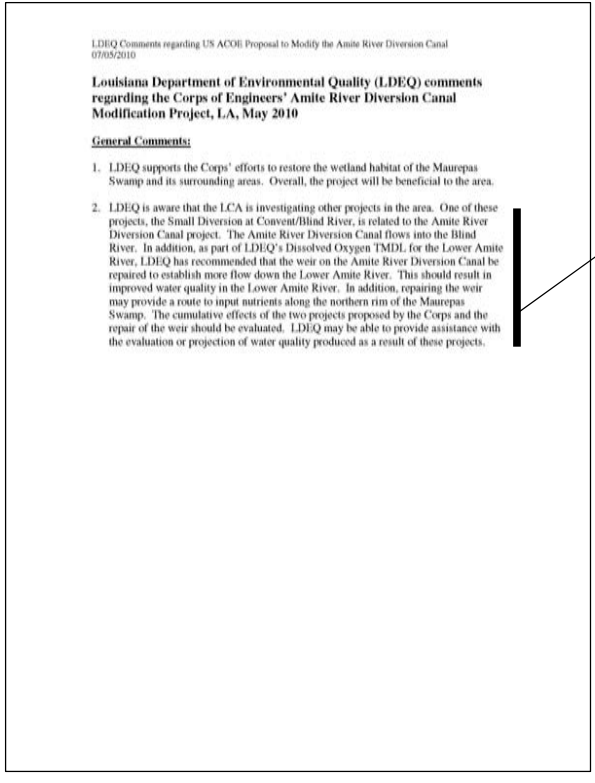
LDWFNO1-3: The USACE has coordinated with the LDWF that the proposed action would not occur within the Blind River Scenic River. Hence, authorization from the LDWF is not required.

Letter #7 (cont'd): Louisiana Department of Wildlife and Fisheries (LDWF)

mw

c: Matthew Weigel, Biologist
Chris Davis, Biologist
Keith Cascio, Scenic Rivers Coordinator
EPA, Marine & Wetlands Section
USFWS Ecological Services

Letter #8: Louisiana Department of Environmental Quality (LDEQ)



LDEQ Comments regarding US ACOE Proposal to Modify the Amite River Diversion Canal
07/05/2010

Louisiana Department of Environmental Quality (LDEQ) comments regarding the Corps of Engineers' Amite River Diversion Canal Modification Project, LA, May 2010

General Comments:

1. LDEQ supports the Corps' efforts to restore the wetland habitat of the Maurepas Swamp and its surrounding areas. Overall, the project will be beneficial to the area.

2. LDEQ is aware that the LCA is investigating other projects in the area. One of these projects, the Small Diversion at Convent/Blind River, is related to the Amite River Diversion Canal project. The Amite River Diversion Canal flows into the Blind River. In addition, as part of LDEQ's Dissolved Oxygen TMDL for the Lower Amite River, LDEQ has recommended that the weir on the Amite River Diversion Canal be repaired to establish more flow down the Lower Amite River. This should result in improved water quality in the Lower Amite River. In addition, repairing the weir may provide a route to input nutrients along the northern rim of the Maurepas Swamp. The cumulative effects of the two projects proposed by the Corps and the repair of the weir should be evaluated. LDEQ may be able to provide assistance with the evaluation or projection of water quality produced as a result of these projects.

LDEQNO1-1: While we recognize that rehabilitation to the weir might be necessary, it was determined that the performance of the weir, with regard to the LCA ARDCM would have little to no effect on restoring the degraded portions of the LCA ARDCM study area. During the preliminary phases of the plan formulation process, rehabilitation of the weir was considered and subsequently screened out due to a lack of restoration opportunities this measure would provide. In addition, rehabilitation of the weir would fall within operations and maintenance responsibility of the local sponsor (Ascension Parish), and would not be within the authorization of the LCA ARDCM.

From: Tom Killeen
Sent: Friday, June 25, 2010 1:52 PM
To: 'lca.ardcm@ucace.army.mil'; Renee Sanders
Subject: LCA ARDC Modification Project

Dear Renee and Bill;

Thank you for the opportunity to participate in the public meeting conducted last night (June 24, 2010) in French Settlement regarding the LCA Amite River Diversion Canal (ARDC) Modification Project. I feel the meeting went very well and your presentations were well prepared, presented and received. LDEQ was pleased to have previously provided a no objection comment to the project on or about June 14, 2010. As both a water quality professional and longtime resident of the ARDC development I am excited about the prospects of this restorative project. The hardwood swamps adjacent to both sides of the ARDC have been in a fairly rapid decline since the 1963 conclusion of the canal construction. In conjunction with the Blind River Diversion Project I believe we are on the right path to restoring these areas to their pre-canal conditions of water flow.

At the meeting I gave you a hard copy of the LDEQ Draft Lower Amite River Watershed TMDL For Biochemical Oxygen-Demanding Substances and Nutrients. Please accept the following link for that document.

http://www.deq.louisiana.gov/portal/portals/0/technology/tmdl/pdf/Draft_Lower_Amite_River_040303_TMDL_Report_080609.pdf

Likewise the large tracts of hardwood swamp within the Lower Amite River Watershed (LARW) have experienced a less acute but equally detrimental decline as result of the ARDC project. In the Technical Summary to the TMDL we state, "LDEQ does recommend that repairs be made to the weir located near the head of the Amite River Diversion Canal. This should re-establish a more reasonable flow through the Lower Amite River."

Further, LDEQ concludes on page 31 of the document, "It is also recommended that the weir dividing flow from the Upper Amite River to the Lower Amite River and the Amite River Diversion Canal be fixed. The weir originally diverted 70% of the flow down the Lower Amite River and 30% of the flow down the Diversion Canal. Over time the weir has eroded (settled). Presently most of the flow diverts down the Diversion Canal. The current lack of flow down the Lower Amite River is a serious source of DO and nutrient impairment."

The LARW has an abundance of natural cuts, gaps, bayous, ditches, etc. in place but suffers from a lack of water to reach them and feed the cypress/tupelo gum hardwood swamp habitats that abound on both sides all the way to Lake Maurepas. A project to restore flow to the LARW by elevating the upper weir structure would be an inexpensive, immediate and permanent fix to a system much larger than the ARDC project area. While I acknowledge that this issue is not within the scope of the ARDC Modification Project I do think we can all agree on the interconnection and interdependency.

I would respectively submit that with a budget of 10 million dollars and an anticipated expense of 7.7 million dollars, an amendment to this project that covered the cost of including within the feasibility study an elevation of the upper weir to a level 12-24 inches above its current height would result in a benefit of this overall restorative project by at least two-fold, while staying within the 10 million dollar cap.

While we welcome the opportunity to pursue future efforts to this end, the idea of accomplish the primary goal of our TMDL within the scope of this project is very compelling. Thus any dialogue we can initiate to facilitate restoration of the Lower Amite River Watershed, either now or in the near future, would be greatly appreciated. I believe Mr. Hudson with GEC has already conducted sufficient hydrologic modeling of flow dynamics at the weir to justify inclusion of a Lower Amite River component.

Again, thank you and your staff for your time and attention to the ARDC Modification Project and any future efforts to partner on a similar endeavor within the Lower Amite River Watershed.

Tom Killeen

LPDES Permit & Water Quality Certification Manager

Office Of Environmental Services, LDEQ

Letter #9: Non-Government Organization (NGO)



July 6, 2010

Colonel Alvin Lee
Commander
New Orleans District U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160

Re: LCA Draft Feasibility Reports and Draft Environmental Impact Statements

Dear Colonel Lee:

Thank you for the opportunity to review and comment on the LCA Draft Feasibility Reports and Draft Environmental Impact Statements. Section 7006(e)(3) of the 2007 WRDA identifies six near-term restoration projects that Congress has authorized for construction subject to, among other things, completion of feasibility studies and a Chief's Report before December 31, 2010. The draft Feasibility Report covers five of those six projects:

- Medium Diversion at White Ditch
- Convey Atchafalaya to Northern Terrebonne Marsh/Multipurpose Operation of the Houma Navigation Canal (HNC) Lock (two projects merged)
- Small Diversion at Convent/Blind River
- Amite River Diversion Canal (ARDC) Modification

Although we were disappointed that the initial deadline of December 31, 2008 was missed, we commend the U.S. Army Corps of Engineers and the State of Louisiana in working diligently to meet the December 31, 2010 as directed by WRDA. It is imperative that these projects are constructed as quickly as possible and our organizations are available to assist to ensure the urgency of these projects is understood in Washington, D.C. and in the State.

We understand the need for additional analysis and the increasing uncertainty of the Terrebonne Basin Barrier Shoreline Project considering the Deepwater Horizon oil spill. However, the Deepwater Horizon oil spill has also shown the urgent need to restore and maintain our barrier island chains to protect the interior marshes from multiple threats, including massive oil spills and hurricanes. We request the USACE to distribute an updated timeline for completion to the public and that timeline ensures that this feasibility report is completed at the earliest possible time with the understanding that some details may have to be modified during the engineering, design and construction phase. We request that the Chief's Report also address an extended deadline for the

Letter #9 (cont'd): Non-Government Organization (NGO)

Terrebonne Basin Barrier Shoreline project that will not be meeting the required WRDA deadline due to these extraordinary circumstances.

We also applaud the USACE and the State of Louisiana for incorporating Monitoring and Adaptive Management Plans at the feasibility stage of project planning. We support the use of project funding to conduct monitoring and expand research and development on these restoration projects to provide lessons learned and flexibility in operations and management. We offer our assistance as the Monitoring and Adaptive Management Plans continue to develop.

Two of the four projects (ARDC Modifications and Atchafalaya to Terrebonne/HNC Lock) were restricted from providing large scale benefits due to the cost constraints authorized in WRDA 2007. The USACE and State of Louisiana boldly expanded the Medium Diversion at White Ditch beyond its cost authorization to adequately address the sustainability of the study area. We commend the USACE and State for this action. We would have liked to see the same initiative to address the concerns of the Maurepas and Terrebonne Basins. Many large-scale restoration measures were considered in these studies, but dismissed due to costs. The ARDC Modification Project only addressed one of the four identified degraded hydrologic units and the Atchafalaya to Terrebonne/HNC Lock Project only reduces the land loss rate by 10 percent over the 50 year period. Much larger scale restoration in these basins is needed. In these instances, the project did not truly meet the objectives of the project in the entire study area. A phased approach to project implementation should be provided that evaluates all needed restoration measures to meet the full objectives of the study without any cost constraints, identifies the critical first steps, and identifies phased project implementation based on available funding.

It is imperative that the USACE complete the Feasibility Reports and the Chief's Report for these LCA projects before the end of the year. Specific comments on each project are enclosed. We believe these comments could be addressed during the engineering, design, construction or adaptive management phases of the projects and will not delay the process.

The undersigned groups welcome the opportunity to discuss our recommendations at any time.

Sincerely,

Coalition to Restore Coastal Louisiana
Steven Peyronnin, Executive Director
Natalie Snider, Science Director

Lake Pontchartrain Basin Foundation
John Lopez, Ph.D.
Director of Coastal Sustainability

NGONO1-1: The TSP meets all the objectives of the project and addresses areas in most critical need of restoration within the study area (NE-2). It has been decided by the USACE that authorization for additional funding will not be south at this time. However, the CIAP program may provide additional funding sources for restoration of the remaining portions of the NER plan above the recommended TSP.

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Letter #9 (cont'd): Non-Government Organization (NGO)

Environmental Defense
Jim Tripp
General Counsel

Angelina Freeman, Ph.D.
Coastal Scientist

National Audubon Society
G. Paul Kemp, Ph.D.
Vice President, Gulf Coast Initiative

National Wildlife Federation
Karla Raettig
National Campaign Director

cc: Garret Graves, Coastal Protection and Restoration Authority
Steve Mathies, Louisiana Office of Coastal Protection and Restoration
Timothy Axtman, U.S. Army Corps of Engineers

Letter #9 (cont'd): Non-Government Organization (NGO)



Medium Diversion at White Ditch
LCA Draft Feasibility Report

A key component to restoration of Louisiana's coastal landscape is to reconnect the Mississippi River to the wetlands by mimicking natural processes that use the power of the Mississippi River to build land and maintain ecological integrity including habitats, communities, and storm buffering capacity. We strongly support the Medium Diversion at White Ditch and its objectives to provide freshwater, nutrients and sediments designed to restore degraded habitat and sustain a larger coastal ecosystem to support and protect the environment, economy, and culture of southern Louisiana.

Much has been learned recently about the design and operation of diversions in the Lower Mississippi River for coastal restoration, including the advantages of using pulsing as an operational strategy to maximize sediment capture (Allison and Meselhe, 2010). With rising sea levels and predictions for increased storm frequency/intensity, it is imperative that restoration projects are designed to maximize potential for offsetting projected land loss. Therefore, we commend and support the Tentatively Selected Plan (TSP) incorporating pulsing at 35,000 cfs (cubic feet per second) at high river flows to maximize sediment capture in the planning and operation of the diversion. The minimal amount of shoaling in the river expected from operation of the diversion in a pulsed fashion (1,000 cfs diversion that is pulsed at 35,000 cfs at the beginning of spring flood when suspended sediment concentrations are significantly elevated) is an additional advantage to this operational regime. Designing flexibility into this diversion project by providing pulsing capacity allows adaptation to unforeseen circumstances, as demonstrated by the Deepwater Horizon oil spill where river diversions were used to keep oil at bay. We applaud the Corps for evaluating a pulsed diversion in the analysis, and agree that the pulsed operation of the TSP maintains the medium diversion category authorization.

The sediment concentrations in the Mississippi River can vary significantly according to location, and a thorough analysis of site specific data and modeling would improve prediction of sediment efficiency and land building potential relative to diversion locations. Extensive sediment data collection and modeling is being undertaken in the White Ditch reach of the river in support of the Myrtle Grove Land Building Diversion. Using this type of data and modeling results in the benefits and drawbacks of location selection would provide a more robust analysis. We suggest incorporation of this additional data in Planning, Engineering, and Design.

The conveyance channel for the TSP accounts for almost half the total cost for the project. We agree that amending language from House/Senate subcommittees that

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Letter #9 (cont'd): Non-Government Organization (NGO)

adjusts the project as authorized in WRDA 2007 for the increase in construction cost is warranted. However, we recommend reevaluating the conveyance channel and whether natural channel formation can be effectively utilized allowing the engineering to be scaled back (thereby reducing cost) to be investigated in Planning, Engineering, and Design. Natural channel formation could be incorporated into the Monitoring and Adaptive Management Plan and funding for channel modifications could be acquired on an as needed basis as a part of Operations and Maintenance.

References

Allison, M.A. and Meselhe, E.A., 2010. The use of large water and sediment diversions in the lower Mississippi River (Louisiana) for coastal restoration. Journal of Hydrology 387, 346-360.

Letter #9 (cont'd): Non-Government Organization (NGO)



Convey Atchafalaya to Northern Terrebonne Marsh/
Multipurpose Operation of the Houma Navigation Canal (HNC) Lock
LCA Draft Feasibility Report

In contrast to the robustness of the Medium Diversion at White Ditch project, the narrowing of ambition in the design of the Convey Atchafalaya to Northern Terrebonne Marsh/Multipurpose Operation of the Houma Navigation Canal (HNC) Lock is striking. As stated in the Draft Feasibility Report:

> *The purpose of the project is to reverse the current trend of marsh degradation in the project area resulting from subsidence, erosion, saltwater intrusion, and lack of sediment and nutrient deposition. The project proposes to accomplish this by utilizing fresh water, sediments, and nutrients from the Atchafalaya River and the Gulf Intracoastal Waterway (GIWW).*

The report goes further to define the objectives of the project to include:

- Prevent, reduce, and/or reverse future wetland loss
- Achieve and maintain characteristics of sustainable marsh hydrology
- Reduce salinity levels in project area
- Increase sediment and nutrient load to surrounding wetlands
- Increase residence time of fresh water
- Sustain productive fish and wildlife habitat

We do not feel that the alternatives developed for this project meet the objectives of the project. Alternative 2 was selected as the Tentatively Selected Plan. However, the TSP will reduce land loss rates by a mere 10 percent over the 50-year project period and this benefit will be lost with intermediate or high relative sea level rise. The Draft Feasibility Report states that modeling of Alternative 3 under intermediate RSLR would reduce the effectiveness of the project by 87 percent and effectiveness of the other alternatives, including the TSP, would be similar. None of the alternatives would prevent marsh collapse at the high RSLR rate.

Although none of the alternatives meet the full objectives of the project, there are benefits to be realized from the project. Based on the description of the eight alternatives available, we feel that Alternative 3 has additional benefits over Alternative 2 and should be selected as the Tentatively Selected Plan (TSP). Alternative 3 includes all the measures in Alternative 2 plus two additional measures in the West – Bayou Penchant Area. To increase flows from the Atchafalaya River, water will be moved from Bayou Shaffer to the Avoca Island Cutoff/Bayou Chene. This will be accomplished by creating an opening through the Avoca Island levee and installing a large gated diversion structure

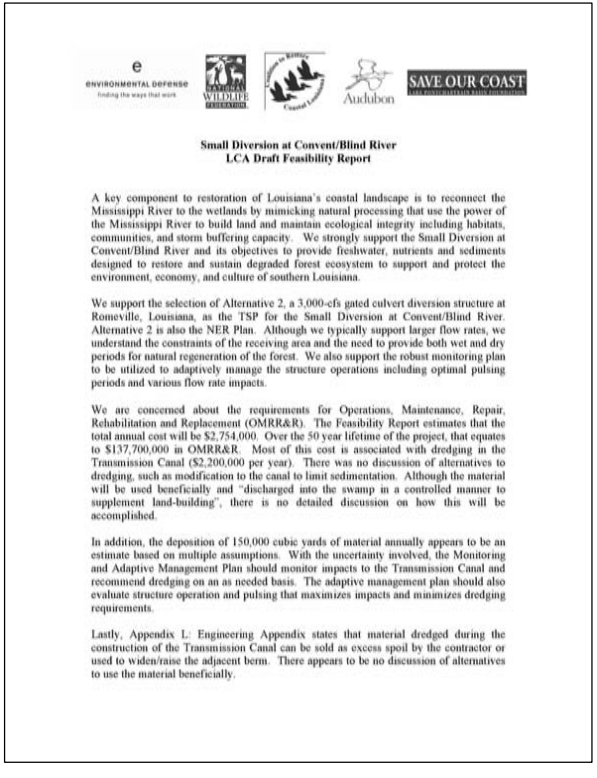
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Letter #9 (cont'd): Non-Government Organization (NGO)

(WS4) in the opening. The remaining measure (WO2) would place stone along the shore of Bayou Chene and Avoca Island Cutoff to protect from increased flows. Alternative 3 would prevent 10,308 acres of emergent marsh soils from being converted to open water over the 50-year period of analysis and would generate 3,325 AAHUs.

Alternative 2, the TSP, does not make any change to the Avoca Island Levee, one of the root causes for problems in this area that this project is designed to address. The northern and central Terrebonne Basin is in dire need to additional freshwater and sediment inputs. While even Alternatives 3 would provide only modest amounts of water and sediment into this deteriorating basin, they would represent a net addition of water and sediment above current levels. We would therefore urge further consideration of a gate diversion structure in a new Avoca Island levee opening, a structure that would return the hydrology of this part of the coast more to the distribution of flows that existing prior to construction of the levee.

Letter #9 (cont'd): Non-Government Organization (NGO)



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NATIONAL WILDLIFE FEDERATION

Louisiana Coastal Coalition

Audubon

SAVE OUR COAST

Small Diversion at Convent/Blind River
LCA Draft Feasibility Report

A key component to restoration of Louisiana's coastal landscape is to reconnect the Mississippi River to the wetlands by mimicking natural processing that use the power of the Mississippi River to build land and maintain ecological integrity including habitats, communities, and storm buffering capacity. We strongly support the Small Diversion at Convent/Blind River and its objectives to provide freshwater, nutrients and sediments designed to restore and sustain degraded forest ecosystem to support and protect the environment, economy, and culture of southern Louisiana.

We support the selection of Alternative 2, a 3,000-cfs gated culvert diversion structure at Romeville, Louisiana, as the TSP for the Small Diversion at Convent/Blind River. Alternative 2 is also the NER Plan. Although we typically support larger flow rates, we understand the constraints of the receiving area and the need to provide both wet and dry periods for natural regeneration of the forest. We also support the robust monitoring plan to be utilized to adaptively manage the structure operations including optimal pulsing periods and various flow rate impacts.

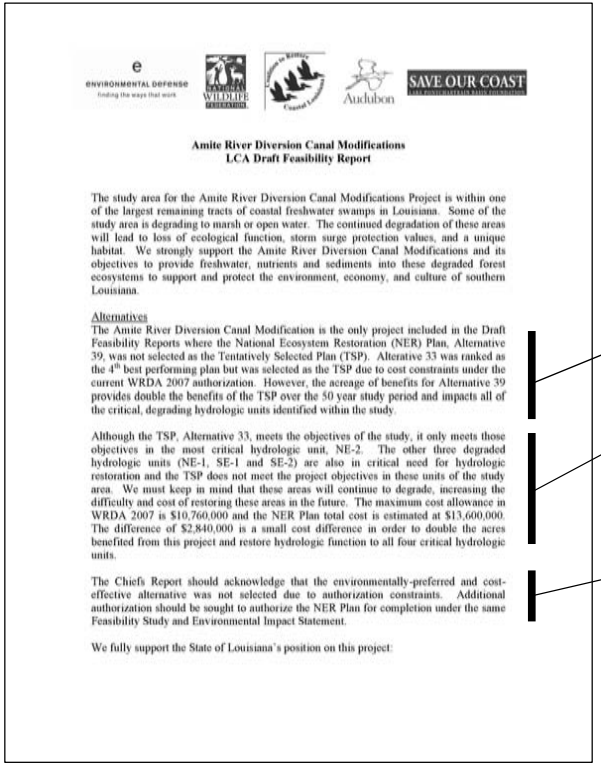
We are concerned about the requirements for Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R). The Feasibility Report estimates that the total annual cost will be $2,754,000. Over the 50 year lifetime of the project, that equates to $137,700,000 in OMRR&R. Most of this cost is associated with dredging in the Transmission Canal ($2,200,000 per year). There was no discussion of alternatives to dredging, such as modification to the canal to limit sedimentation. Although the material will be used beneficially and "discharged into the swamp in a controlled manner to supplement land-building", there is no detailed discussion on how this will be accomplished.

In addition, the deposition of 150,000 cubic yards of material annually appears to be an estimate based on multiple assumptions. With the uncertainty involved, the Monitoring and Adaptive Management Plan should monitor impacts to the Transmission Canal and recommend dredging on an as needed basis. The adaptive management plan should also evaluate structure operation and pulsing that maximizes impacts and minimizes dredging requirements.

Lastly, Appendix L: Engineering Appendix states that material dredged during the construction of the Transmission Canal can be sold as excess spoil by the contractor or used to widen/raise the adjacent berm. There appears to be no discussion of alternatives to use the material beneficially.

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Letter #9 (cont'd): Non-Government Organization (NGO)



e ENVIRONMENTAL DEFENSE finding the ways that work

SAVE OUR COAST

Audubon

Amite River Diversion Canal Modifications
LCA Draft Feasibility Report

The study area for the Amite River Diversion Canal Modifications Project is within one of the largest remaining tracts of coastal freshwater swamps in Louisiana. Some of the study area is degrading to marsh or open water. The continued degradation of these areas will lead to loss of ecological function, storm surge protection values, and a unique habitat. We strongly support the Amite River Diversion Canal Modifications and its objectives to provide freshwater, nutrients and sediments into these degraded forest ecosystems to support and protect the environment, economy, and culture of southern Louisiana.

Alternatives

The Amite River Diversion Canal Modification is the only project included in the Draft Feasibility Reports where the National Ecosystem Restoration (NER) Plan, Alternative 39, was not selected as the Tentatively Selected Plan (TSP). Alterative 33 was ranked as the 4th best performing plan but was selected as the TSP due to cost constraints under the current WRDA 2007 authorization. However, the acreage of benefits for Alternative 39 provides double the benefits of the TSP over the 50 year study period and impacts all of the critical, degrading hydrologic units identified within the study.

Although the TSP, Alternative 33, meets the objectives of the study, it only meets those objectives in the most critical hydrologic unit, NE-2. The other three degraded hydrologic units (NE-1, SE-1 and SE-2) are also in critical need for hydrologic restoration and the TSP does not meet the project objectives in these units of the study area. We must keep in mind that these areas will continue to degrade, increasing the difficulty and cost of restoring these areas in the future. The maximum cost allowance in WRDA 2007 is $10,760,000 and the NER Plan total cost is estimated at $13,600,000. The difference of $2,840,000 is a small cost difference in order to double the acres benefited from this project and restore hydrologic function to all four critical hydrologic units.

The Chiefs Report should acknowledge that the environmentally-preferred and cost-effective alternative was not selected due to authorization constraints. Additional authorization should be sought to authorize the NER Plan for completion under the same Feasibility Study and Environmental Impact Statement.

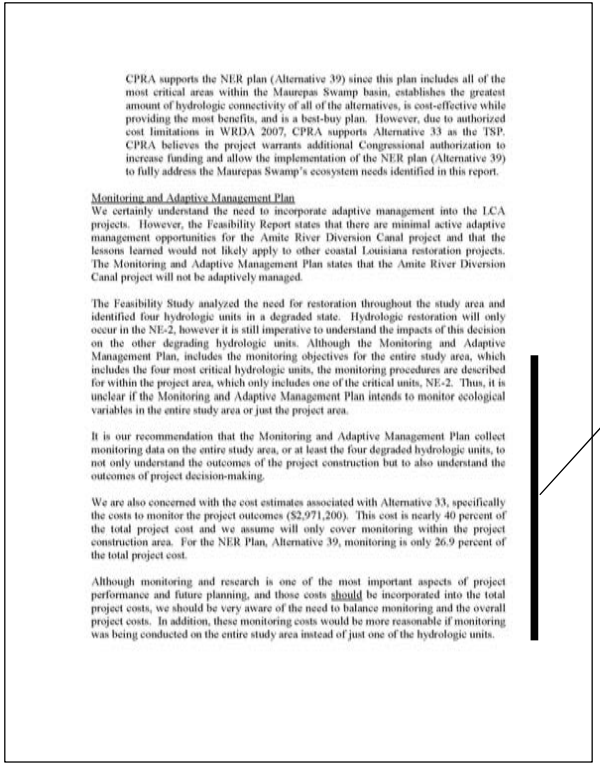
We fully support the State of Louisiana's position on this project.

NGONO1-2: The rationale for selection of the TSP over the NER and other, higher-ranked alternatives is discussed in Volume II, Sections 3.7 and 3.7.11.1 of the report.

NGONO1-3: WRDA 2007, which provides authorization for this project, specifies a cost limit of $10.7 million, which must be adhered to.

NGONO1-4: It has been decided by the USACE that authorization for additional funding will not be sought at this time.

Letter #9 (cont'd): Non-Government Organization (NGO)



CPRA supports the NER plan (Alternative 39) since this plan includes all of the most critical areas within the Maurepas Swamp basin, establishes the greatest amount of hydrologic connectivity of all of the alternatives, is cost-effective while providing the most benefits, and is a best-buy plan. However, due to authorized cost limitations in WRDA 2007, CPRA supports Alternative 33 as the TSP. CPRA believes the project warrants additional Congressional authorization to increase funding and allow the implementation of the NER plan (Alternative 39) to fully address the Maurepas Swamp's ecosystem needs identified in this report.

Monitoring and Adaptive Management Plan

We certainly understand the need to incorporate adaptive management into the LCA projects. However, the Feasibility Report states that there are minimal active adaptive management opportunities for the Amite River Diversion Canal project and that the lessons learned would not likely apply to other coastal Louisiana restoration projects. The Monitoring and Adaptive Management Plan states that the Amite River Diversion Canal project will not be adaptively managed.

The Feasibility Study analyzed the need for restoration throughout the study area and identified four hydrologic units in a degraded state. Hydrologic restoration will only occur in the NE-2, however it is still imperative to understand the impacts of this decision on the other degrading hydrologic units. Although the Monitoring and Adaptive Management Plan, includes the monitoring objectives for the entire study area, which includes the four most critical hydrologic units, the monitoring procedures are described for within the project area, which only includes one of the critical units, NE-2. Thus, it is unclear if the Monitoring and Adaptive Management Plan intends to monitor ecological variables in the entire study area or just the project area.

It is our recommendation that the Monitoring and Adaptive Management Plan collect monitoring data on the entire study area, or at least the four degraded hydrologic units, to not only understand the outcomes of the project construction but to also understand the outcomes of project decision-making.

We are also concerned with the cost estimates associated with Alternative 33, specifically the costs to monitor the project outcomes ($2,971,200). This cost is nearly 40 percent of the total project cost and we assume will only cover monitoring within the project construction area. For the NER Plan, Alternative 39, monitoring is only 26.9 percent of the total project cost.

Although monitoring and research is one of the most important aspects of project performance and future planning, and those costs should be incorporated into the total project costs, we should be very aware of the need to balance monitoring and the overall project costs. In addition, these monitoring costs would be more reasonable if monitoring was being conducted on the entire study area instead of just one of the hydrologic units.

NGONO1-5: The monitoring and adaptive management plan proposes a total of six monitoring sites. Three sites would be in the project area that would be directly influenced by project implementation and three sites would be in the larger surrounding study area for reference. Monitoring costs are already 40% of the total project costs, if monitoring was expanded as recommended to include entire study area, monitoring costs would greatly increase and may exceed entire project construction cost making the project not feasible. The development monitoring plan has selected the areas needed to make decisions regarding project success. This point will be clarified within the Monitoring Plan.

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Letter #10: Louisiana Department of Environmental Quality (LDEQ)

July 8, 2010

Joan M. Exnicios, Chief

USACE Environ.Planning Branch

P.O. Box 60267

New Orleans, LA 70160-0267

william.p.klein.jr@usace.army.mil <mailto:william.p.klein.jr@usace.army.mil>

RE:

100603/1015

USACE DRAFT EIS - LCA-Vol. II

(on disk)

Amite River Div. Canal Mod. EIS

Ascension and Livingston Parishes

Dear Ms. Exnicios:

The Department of Environmental Quality (LDEQ), Offices of Environmental Services and Environmental Compliance have received your request for comments on the above referenced project. Please take any necessary steps to obtain and/or update all necessary approvals and environmental permits regarding this proposed project.

Mr. Yasoob Zia and the Air Quality Assessment Division have no objections regarding this project in the nonattainment parishes of Ascension and Livingston based upon your revised VOC & NOx emissions tables in your letter submitted to us. However, the following comments have been included below.
Should you encounter a problem during the implementation of this project, please notify LDEQ's Single-Point-of-contact (SPOC) at (225) 219-3640.

Letter #10 (cont'd): Louisiana Department of Environmental Quality (LDEQ)

The Office of Environmental Services/Permits Division recommends that you investigate the following requirements that may influence your proposed project:

* If your project results in a discharge to waters of the state, submittal of a Louisiana Pollutant Discharge Elimination System (LPDES) application may be necessary.
* If the project results in a discharge of wastewater to an existing wastewater treatment system, that wastewater treatment system may need to modify its LPDES permit before accepting the additional wastewater.
* LDEQ has stormwater general permits for construction areas equal to or greater than one acre. It is recommended that you contact the LDEQ Water Permit Division at (225) 219-3181 to determine if your proposed improvements require one of these permits.
* All precautions should be observed to control nonpoint source pollution from construction activities.
* If any of the proposed work is located in wetlands or other areas subject to the jurisdiction of the U.S. Army Corps of Engineers, you should contact the Corps directly to inquire about the possible necessity for permits. If a Corps permit is required, part of the application process may involve a water quality certification from LDEQ.
* All precautions should be observed to protect the groundwater of the region.
* Please be advised that water softeners generate wastewaters that may require special limitations depending on local water quality considerations. Therefore if your water system improvements include water softeners, you are advised to contact the LDEQ Water Permits to determine if special water quality-based limitations will be necessary.
* Any renovation or remodeling must comply with LAC 33:III.Chapter 28.Lead-Based Paint Activities, LAC 33:III.Chapter 27.Asbestos-Containing Materials in Schools and State Buildings (includes all training and accreditation), and LAC 33:III.5151.Emission Standard for Asbestos for any renovations or demolitions.
* If any solid or hazardous wastes, or soils and/or groundwater contaminated with hazardous constituents are encountered during the project, notification to LDEQ's Single-Point-of-Contact (SPOC) at (225) 219-3640 is required. Additionally, precautions should be taken to protect workers from these hazardous constituents.

Currently, Ascension and Livingston Parishes are classified as nonattainment with the National Ambient Air Quality Standards.

Please forward all future requests to Ms. Diane Hewitt, LDEQ/Performance Management/ P.O. Box 4301, Baton Rouge, LA 70821-4301, and your request will be processed as quickly as possible.

LDEQNO2-1: Section 7 discusses all coordination and compliance applicable to this project.

Letter #10 (cont'd): Louisiana Department of Environmental Quality (LDEQ)

If you have any questions, please feel free to contact me at (225) 219-4079 or by email at diane.hewitt@la.gov <mailto:diane.hewitt@la.gov> . Permitting questions should be directed to the Office of Environmental Services at (225) 219-3181.

Sincerely,

Diane Hewitt

Performance Management

LDEQ/Community and Industry Relations

Business and Community Outreach Division

Office of the Secretary

P.O. Box 4301 (602 N. 5th Street)

Baton Rouge, LA 70821-4301

Phone: 225-219-4079

Fx: 225-325-8208

E-mail: diane.hewitt@la.gov

Appendix H

VALUE ENGINEERING REPORT

Value Engineering Study Report



Small Diversion at Convent/Blind River
Amite River Diversion Canal Modification
Medium Diversion at White Ditch

CEMVN-VE-09-05

US Army Corps of Engineers®

June 2009

Prepared by

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Subject: Value Engineering Study Report – Final
Small Diversion at Convent/Blind River
Amite River Diversion Canal Modification
Medium Diversion at White Ditch

Mr. Vicidomina:

Value Management Strategies, Inc. is pleased to transmit an electronic copy of the Final Value Engineering Study Report.

This report summarizes the results and events of the study conducted May 18 through 22, 2009, in New Orleans, Louisiana.

We enjoyed working with you and are looking forward to continuing our efforts to assist the New Orleans District U.S. Army Corps of Engineers in its value engineering efforts.

Sincerely,

VALUE MANAGEMENT STRATEGIES, INC.

Mark Watson, PE, CVS
VE Study Team Leader

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EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering (VE) Study Report summarizes the events of the VE workshop conducted May 18 – 22, 2009 for the U.S. Army Corps of Engineers (USACE), New Orleans District, by Value Management Strategies, Inc. The subject of the study was a group of three Louisiana Coastal Area (LCA) ecological restoration projects: Small Diversion at Convent/Blind River, Amite River Diversion Canal Modification, and Medium Diversion at White Ditch.

This study was conducted at the Feasibility Scoping Report/Preliminary Draft EIS, an early stage of project development, and as such is the beginning of plan formulation.

VE STUDY RESULTS

The VE team developed 32 alternative concepts which are intended to assist the USACE in better formulating plans to carry forward into the next phase of project development.

These recommendations are categorized per subject project, as well as those that pertain to general plan formulation.

Major findings of the workshop are summarized as follows:

Small Diversion at Convent/Blind River

U.S. Highway 61 (US 61) bisects the Convent/Blind River project site from northwest to southeast. Roughly paralleling the highway is an active railroad to the south. Both of these transportation routes act as a "dam" to the transfer, from south to north, of fresh water taken from the Mississippi River, except where the Blind River flows under the railroad and highway on its way to Lake Maurepas. In addition, Blind River acts as a "sink", collecting the diverted/distributed water from the swamp and conveying it out of the study area. Finally, one of the key project constraints is to not adversely impact flood control projects in the area.

Key VE alternatives identified to address these issues are as follows:

- Hydrologic impoundment from US 61 and railroad grade
  - Provide method for transferring water under railroad and US 61 to the north restoration area. Proposed methods include jacking and boring of pipe culverts under both the railroad and the highway, installing shallow concrete box culverts under US 61, and installing small pumps at low spots on the south side of the highway and railroad.
- Distribution and control of freshwater into project area while not adversely impacting flood control
  - Use Blind River to distribute freshwater to project area
  - Consider reversible pumping of proposed river siphons and provide local drainage improvement to facilitate low river stage diversion flow

Amite River Diversion Canal Modification

The project site has been divided into eight subunits based on topographic high points or natural and artificial channels that serve to impede or intercept hydrologic flows. One of the goals of this project is to improve hydrologic connectivity between the subunits. A relic railroad grade traversing the study area from north to south in the eastern study area is one of the key hydrologic impairments. The study area is focused around the impaired bald cypress-tupelo swamp stands adjacent to the Amite River Diversion Canal.

Key VE alternatives identified to address these issues are as follows:

- Increase size and number of gaps in railroad ridge and use spoils to enhance habitat of remaining ridges

Medium Diversion at White Ditch

Presently, loss of area in the marsh allows water to rapidly pass through the system and salt water is able to quickly intrude. The absence of an outfall management plan related to the White Ditch diversion siphon results in the surrounding marsh receiving limited benefits from the diverted river water. Also, the lack of marsh-forming sediments from the Mississippi River has accelerated the degradation of all marsh types. Sediment needs in the project area are extensive and plan strategies that increase diversion flows to provide required sediment transport may not be sufficient to provide the necessary sediment.

Key VE alternatives identified to address these issues are as follows:

- Maximize sediment introduction
  - Design diversion structures to maximize sediment introduction
  - Install sediment introduction system into White Ditch diversion structure
- Diversion control structure size and location
  - Construct a combination spillway with capacity controls to medium diversion levels
  - Construct diversion structure approximately seven miles south of Phoenix
- Address fresh water source and transport
  - Optimize flow conveyance in White Ditch to feed areas immediately adjacent to the south of existing channel

General/Plan Formulation

- Develop Plan Strategies that account for much higher levels of global sea level (GSL) rise

  One issue addressed by the VE team spans all three projects and has ramifications throughout the LCA program. Currently, work is underway by the USACE, National Oceanic and Atmospheric Administration (NOAA), and United States Geological Survey (USGS) to investigate the glacial melt contribution to future GSL rise. Project benefits depend upon habitats maintained above sea level. Consequently, benefits beyond the 50-year planning horizon will be lost if subsidence and GSL rise exceed the current

assumptions. The rate of GSL rise in the future is currently unknown, but could be much greater than the current assumptions. As such, the projects should develop specific Plan Strategies that consider the range of possible future GSL rates.

- Provide clarification and address the Water Resources Development Act of 2007 (WRDA 2007) regarding specified authorized funding limits and the extent of planning development of LCA projects

  Each LCA project has a specific level of funding to accomplish the authorized project goals and objectives as described in the LCA Program. However, during the plan formulation phase of the studies, stipulations (cost and/or size, as well as time) should not serve as planning constraints. Consideration of all reasonable alternatives to achieve the goals and objectives of the project, regardless of the time, cost, and/or size, is required by USACE policy. The USACE policy guidance requires identification of a National Ecosystem Restoration (NER) plan that maximizes ecosystem restoration benefits compared to costs, in addition to the identification of a Tentatively Select Plan (TSP). In some cases, the NER plan may differ from the TSP by exceeding the authorization stipulations resulting in time, cost, and/or size serving as constraints for the plan selection phase of the study. This forces the TSP to be an alternative that would accomplish the ecosystem benefits within the WRDA authorization.

SUMMARY OF VE ALTERNATIVE CONCEPTS

The table below summarizes all of the alternative concepts developed by the VE team. The items in **red** text were identified by the VE team as items of particular note and key recommended strategies for the Project Development Team (PDT) to consider.

SUMMARY OF VE ALTERNATIVE CONCEPTS
Small Diversion at Convent/Blind River
Amite River Diversion Canal Modification
Medium Diversion at White Ditch

Number	Description
Small Diversion at Convent/Blind River	
CB-1	**Provide method for transferring water under railroad and US 61 to the north restoration area**
CB-2	**Use Blind River to distribute fresh water to project area**
CB-3	**Consider reversible pumping of proposed river siphons or to facilitate low river stage diversion flow**
CB-4	Construct "environmentally friendly" conveyance channels
CB-5	Define the hydrologic connectivity of project areas
CB-6	Obtain Total Maximum Daily Load (TMDL) waiver for diversion into Blind River
Amite River Diversion Canal Modification	
A-1	**Increase size and number of gaps in railroad ridge**
A-2	Use railroad ridge as an oak tree habitat
A-3	Develop alternative that maximizes long-term fresh water content of Lake Maurepas as potential buffer to a major salt water inflow event
Medium Diversion at White Ditch	
WD-1	**Design diversion structures to maximize sediment introduction**
WD-2	**Optimize quantity of freshwater diverted at White Ditch in combination with other proposed diversion projects**
WD-3	**Construct diversion structure approximately seven miles south of Phoenix**
WD-4	**Construct a combination spillway with capacity controls to medium diversion levels**
WD-5	**Install sediment introduction system into White Ditch diversion structure**
WD-6	Optimize flow conveyance in White Ditch
WD-7	Identify and incorporate impacts effects of subsidence due to fluid withdrawal into project analysis
General/Plan Formulation	
G-1	**Develop Plan Strategies accounting for rise in sea level**
G-2	**Provide clarification and address the WRDA 2007 regarding specified authorized funding limits and the extent of planning development of LCA projects**
G-3	Define plan alternatives that can be optimized within project authorization
G-4	Amend project authorizations to include additional federal funding for "first phase" adaptive management measures
G-5	Establish permanent trust fund for project maintainability
G-6	Identify impacts of multiple diversion structures on Mississippi River and fresh water and sediment requirements of project areas
G-7	Incorporate comprehensive monitoring of project benefits before, during, and after completion of diversion measures
G-8	Identify and address potential real and perceived drainage impact of proposed diversion flows
G-9	Redefine project constraints versus project issues
G-10	Revisit weighted matrix method of ranking initial alternatives and plan elements

Number	Description
G-11	Redefine structural versus non-structural items
G-12	Develop salt tolerant bald cypress variety for use in coastal swamp restoration efforts
G-13	Use Ascension Parish wastewater effluent to replenish cypress forests
G-14	Use self-regulating tide gates for flap gates
G-15	Consider using vinyl sheet pile in guide levees for proposed diversion outlet channels
G-16	Consider effects of nutria in project analysis

Full Report Available Upon Request

Appendix I

ADAPTIVE MANAGEMENT/ MONITORING PLAN

Louisiana Coastal Area (LCA) Program:
Amite River Diversion Canal Modification Project
Feasibility-Level Monitoring and Adaptive Management Plan

July 29, 2010





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Annex 1. Amite River Diversion Canal Modification Project Conceptual Ecological Model

1.0 INTRODUCTION

This document outlines the feasibility-level monitoring and adaptive management plan for the Louisiana Coastal Area (LCA) Program: Amite River Diversion Canal Modification project. The LCA Adaptive Management Framework Team developed this monitoring and adaptive management plan with assistance from the Project Delivery Team (PDT). This plan identifies and describes the monitoring and adaptive management activities proposed for the project and estimates their cost and duration. This plan will be further developed in the preconstruction, engineering, and design (PED) phase as specific design details are made available.

1.1 Authorization for Adaptive Management in the LCA Program

The LCA Ecosystem Restoration Study Chief's Report (2005) states (for the 15 near-term features aimed at addressing the critical restoration needs)

> *" …the feasibility level of detail decision documents will identify specific sites, scales, and adaptive management measures, and will optimize features and outputs necessary to achieve the restoration objectives…to ensure that LCA ecosystem restoration objectives are realized, monitoring and adaptive management must be a critical element of LCA projects."*

Section 7003(a) of Water Resources Development Act of 2007 (WRDA 2007) stipulates:

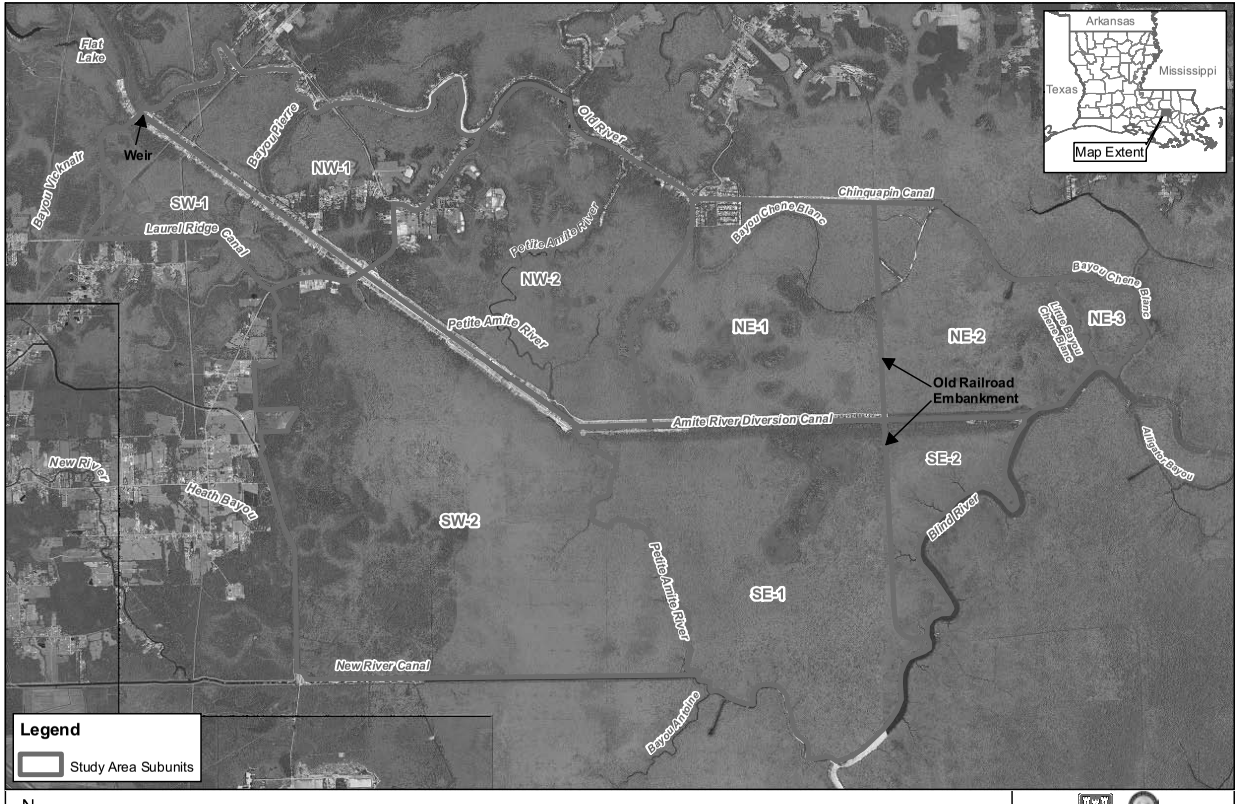
> *"The Secretary may carry out a program for ecosystem restoration, Louisiana Coastal Area, Louisiana, substantially in accordance with the report of the Chief of Engineers, dated January 31, 2005*."

Additionally, Section 2039 of WRDA 2007 directs the Secretary of the Army to ensure that, when conducting a feasibility study for a project (or component of a project) for ecosystem restoration, the recommended project includes a plan for monitoring the success of the ecosystem restoration. The implementation guidance for Section 2039, in the form of a CECW-PB Memo dated 31 August 2009, also requires that an adaptive management plan be developed for all ecosystem restoration projects.

At the programmatic level, knowledge gained from monitoring one project can be applied to other projects. Opportunities for this type of adaptive management are common for the projects within the LCA Ecosystem Restoration Study (USACE 2004), which also builds upon lessons learned in other related efforts such as the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). Oversight by the LCA Science and Technology (S&T) Program and the LCA Adaptive Management Planning Team provides the basic structure to ensure that knowledge gained is effectively shared across programs and projects.

1.2 Procedure for Drafting Adaptive Management Plans for LCA Projects

The U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District (USACE MVN), Louisiana Office of Coastal Protection and Restoration (OCPR), and the LCA S&T Office collaborated to establish a general framework for adaptive management to be applied to all LCA projects. The framework for adaptive management is consistent with the previously mentioned implementation guidance, as well as with the guidance provided by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's (NOAA) "Availability of a Final Addendum to the Handbook for Habitat Conservation Planning



STUDY AREA AND SUBUNITS

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Ascension and Livingston Parishes USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 2
Date: October 2009
Scale: 1:80,000
Source: USDA/GEC
Map ID: 27850108-1780

and Incidental Take Permitting Process" in Federal Register vol. 65, No. 106 35242. The LCA adaptive management framework includes both a set-up phase (Figure 1) and an implementation phase (Figure 2).

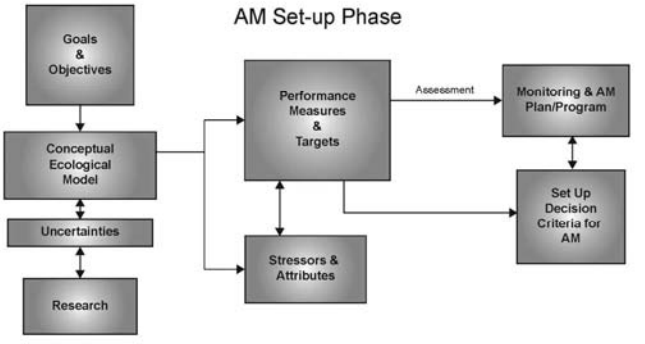


Figure 1. Set-up Phase of the LCA Adaptive Management Framework.

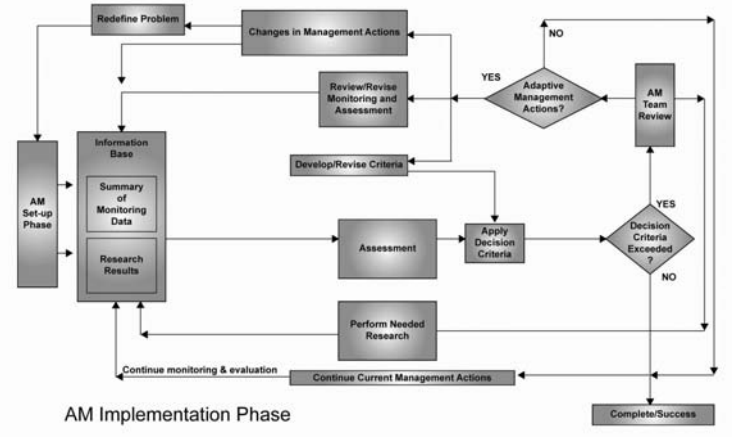


Figure 2. Implementation Phase of the LCA Adaptive Management Framework.

1.3 LCA Communication Structure for Implementation of Adaptive Management

To execute an adaptive management strategy for the LCA Ecosystem Restoration Plan, a communication structure has been identified (Figure 3). The structure establishes clear lines of communication between LCA Program Management, an Adaptive Management Planning Team, the S&T Program, PDTs, and stakeholders. Successful implementation will require the right resources being coupled at the right time to support the framework components.

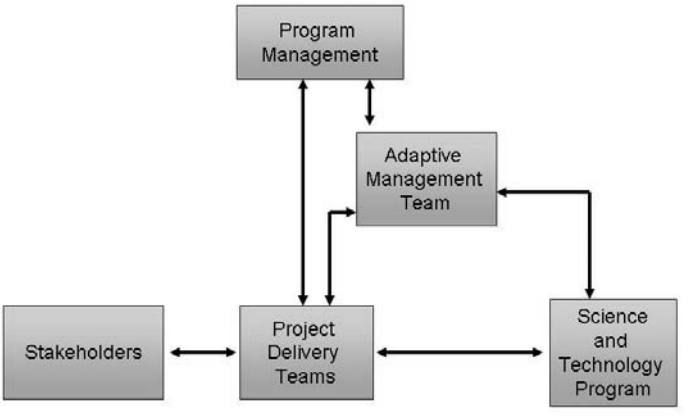


Figure 3. LCA Communication Structure for Implementation of Adaptive Management.

As part of the LCA Program communication structure for implementation of adaptive management (Figure 3), an LCA Adaptive Management Planning Team will be established. This team will be led jointly by a Senior Planner from the USACE and a counterpart from the OCPR. Other team members include USACE and State support staff and representatives from USFWS, NOAA, Natural Resources Conservation Service (NRCS), and Louisiana Department of Wildlife and Fisheries (LDWF). These members will be selected on the basis of their knowledge of ecosystem restoration, coastal Louisiana ecosystems and adaptive management. Other resources and expertise will be brought in as needed. This team will be responsible for recommending project and program adaptive management actions to the LCA Management Team.

The LCA Science and Technology (S&T) Office was established by the USACE and the State of Louisiana (the non-Federal sponsor) to effectively address coastal ecosystem restoration needs and to provide a strategy, organizational structure, and process to facilitate integration of science

and technology into the adaptive management process. Under the Adaptive Management Framework, there are five primary elements in the LCA S&T Program, and each element differs in emphasis and requirements. These elements include: (1) science information needs, (2) data acquisition and monitoring, (3) modeling, (4) research, and (5) data management and reporting (assessment).

Under the LCA S&T Office, an Assessment Team will be established. This team will be led by the S&T Director and a representative of the U.S. Geological Survey (USGS) who will also serve as direct liaisons between the S&T Assessment Team and the LCA Adaptive Management Planning Team. Other members will be identified from Federal and State agencies. Responsibilities of this team include analysis and reporting of data to the LCA Adaptive Management Planning Team and the LCA Program Management Team.

2.0 PROJECT ADAPTIVE MANAGEMENT PLANNING

Specific LCA PDTs assisted the LCA Adaptive Management Framework Team in developing the monitoring and adaptive management plan for each specific project. The members of the Adaptive Management Framework Team for this project were Tomma Barnes, USACE-MVN ; Steve Bartell, E2 Consulting Engineers; Laura Brandt, USFWS; Craig Fischenich, USACE/Engineer Research and Development Center; Barbara Kleiss, USACE Mississippi Valley Division; Carol Parsons Richards, OCPR; Greg Steyer, USGS National Wetlands Research Center; and John Troutman, OCPR.

The resulting adaptive management plan for the Amite River Diversion Canal Modification project describes and justifies whether adaptive management is needed in relation to the tentatively selected plan (TSP) identified in the Feasibility Study. The plan also identifies how adaptive management would be conducted for the project and who would be responsible for this project-specific adaptive management program. The developed plan outlines how the results of the project-specific monitoring program would be used to adaptively manage the project, including specification of conditions that would demonstrate project success.

The Adaptive Management Plan for this project reflects a level of detail consistent with the project Feasibility Study. The primary intent was to develop monitoring and adaptive management actions appropriate for the project's restoration goals and objectives. The specified management actions permit estimation of the adaptive management program costs and duration for the project.

The following adaptive management plan section (1) identifies the restoration goals and objectives identified for the Amite River Diversion Canal Modification project, (2) outlines management actions that can be undertaken to achieve the project goals and objectives, (3) presents a conceptual ecological model that relates management actions to desired project outcomes, and (4) lists sources of uncertainty. Subsequent sections describe monitoring, data management, and assessment in support of monitoring and adaptive management.

The level of detail in this plan is based on currently available data and information developed during plan formulation as part of the feasibility study. Uncertainties remain concerning the exact project features, monitoring elements, and adaptive management opportunities. Components of the monitoring and adaptive management plan, including costs, were similarly estimated using currently available information. Uncertainties will be addressed in the preconstruction, engineering, and design (PED) phase, and a detailed monitoring and adaptive

management plan, including a detailed cost breakdown, will be drafted as a component of the design document.

2.1 Project Goals and Objectives

During initial stages of project development, the project delivery team, with stakeholder input, developed restoration goals and objectives to be achieved by the Amite River Diversion Canal Modification project. These goals and objectives were subsequently refined through interactions with the LCA Adaptive Management Framework Team. The overarching goal of the LCA Program is to contribute toward achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation. The goal of this project is to reverse the trend of degradation within the western Maurepas Swamp ecosystem. The swamp has been adversely affected by the construction of the Amite River Diversion Canal (ARDC) ....The specific restoration objectives of the project are to:

- Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients.
- Facilitate natural hydrologic cycles within the study area by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC which would improve tree productivity and seedling germination.
- Reduce habitat conversion of swamp to marsh and open water within the study area.
- Improve fish and wildlife habitat within the study area.

2.2 Management and Restoration Actions

The PDT performed a thorough plan formulation process to identify potential management measures and restoration actions that address the project objectives. Many alternatives were considered, evaluated, and screened in producing a final array of alternatives. The PDT subsequently identified a tentatively selected plan (TSP).

The project TSP is Alternative 33. This alternative has three openings on the north bank of the ARDC, with the westernmost cut also extending through the railroad grade; three bifurcated conveyance channels; side casting of dredged material; one cut in the railroad grade north of the ARDC; and dredged material berm (spoil bank) and swamp floor vegetative plantings.

2.3 Conceptual Ecological Model for Monitoring and Assessment

As part of the planning process, members of the Amite River Diversion Canal Modification project PDT developed a conceptual ecological model for the swamp ecosystem in the project area to represent current understanding of ecosystem structure and function in the project area, identify performance measures, and help select parameters for monitoring (Annex 1). The model illustrates the effects of important natural and anthropogenic activities that result in different ecological stressors on the system. The effects of concern can be measured for selected performance measures defined as specific physical, chemical, and biological attributes of the system.

2.4 Sources of Uncertainty

Adaptive management provides a coherent process for making decisions in the face of uncertainty. Scientific uncertainties and technological challenges are inherent with any large-scale ecosystem restoration project. There are many uncertainties associated with restoration of the coastal wetland systems included in the Amite River Diversion Canal Modification project. Some of the more significant uncertainties include the following:

- Effects of sea-level changes within the project area.
- Effect of subsidence within the project area.
- Effects of hurricanes over the next fifty years.

Potential climate change issues, such as sea level rise, in addition to regional subsidence rates are significant scientific uncertainties for all LCA projects. These issues were incorporated in the plan formulation process and will be monitored by gathering data on water levels, salinities, and land elevation. These data will inform adaptive management actions, but future climate change projections remain highly uncertain at this time.

3.0 RATIONALE FOR ADAPTIVE MANAGEMENT

The primary incentive for implementing an adaptive management program is to increase the likelihood of achieving desired project outcomes given the identified uncertainties. All projects face uncertainties with the principal sources of uncertainty including (1) incomplete description and understanding of relevant ecosystem structure and function, (2) imprecise relationships between project management actions and corresponding outcomes, (3) engineering challenges in implementing project alternatives, and (4) ambiguous management and decision-making processes.

Given these uncertainties, adaptive management provides an organized, coherent, and documented process that suggests management actions in relation to measured project performance compared to desired project outcomes. In the case of Amite River Diversion Canal Modification project, an adaptive management program would use the results of continued project monitoring to manage the project in order to achieve the previously stated project goals and objectives. Adaptive management establishes the critical feedback of information from project monitoring to inform project management and promote learning through reduced uncertainty.

Several questions were considered to determine if adaptive management should be applied to the Amite River Diversion Canal Modification project:

1) Are the ecosystems to be restored sufficiently understood in terms of hydrology and ecology, and can project outcomes be accurately predicted given recognized natural and anthropogenic stressors?

2) Can the most effective project design and operation to achieve project goals and objectives be readily identified?

3) Are the measures of this restoration project's performance well understood and agreed upon by all parties?

4) Can project management actions be adjusted in relation to monitoring results?

A 'NO' answer to questions 1 through 3 and a "YES" answer to question 4 identifies the project as a candidate that could benefit from adaptive management.

Answers to questions 1 through 3 were "NO." However, the Adaptive Management Framework Team determined that the Amite River Diversion Canal Modification project was not a good candidate for adaptive management because there are no actions that could be taken in response to monitoring results that the USACE would define as adaptive management actions. That is, the answer to question 4 is "NO." Although some activities could be conducted to adjust project performance, these actions would not be considered adaptive management activities. O&M for the selected plan include a yearly inspection of the bank opening locations and conveyance channels to ensure that there are no flow interruptions, such as from debris or fallen trees, which could improve project performance. However if monitoring data indicate that actions beyond yearly O&M (i.e changing the shape, size, branching, or number of conveyances channels or gaps) would be needed these would be considered structural changes and are beyond the adaptive management authority. The USACE and State of Louisiana can initiate the process for developing a new water resources project or pursue a design deficiency under the constructed project. The Framework Team also considered opportunities for active adaptive management by designing the project as a management experiment. The Team determined there were minimal active adaptive management opportunities for the project and that any lessons learned would be limited and would not likely apply to other coastal Louisiana restoration projects. While there are currently no apparent adaptive management opportunities, the Adaptive Management Planning Team can examine the performance of the project in the future. If it is determined during PED that adaptive management could help achieve any unfulfilled project objectives, the Team can recommend adaptive management for the project at that time.

4.0 MONITORING

Independent of adaptive management, an effective monitoring program will be required to determine if the project outcomes are consistent with original project goals and objectives. The power of a monitoring program developed to support adaptive management lies in the establishment of feedback between continued project monitoring and corresponding project management. A carefully designed monitoring program is central to properly assessing the effects of the Amite River Diversion Canal Modification project.

4.1 Rationale for Monitoring

Monitoring must be closely integrated with all other LCA program components because it is the key to the evaluation and learning components of adaptive management. Project and system level objectives must be identified to determine appropriate indicators to monitor. In order to be effective, monitoring designs must be able to discern ecosystem responses caused by project implementation (i.e., management actions) from natural variability. In coastal Louisiana, there are many existing restoration and protection projects already constructed, and many more are planned under different authorizations and programs. In combination, these projects will ultimately influence much of coastal Louisiana. Monitoring must therefore be conducted at project and system-wide scales to evaluate long-term, large-scale status and trends and short-term performance.

Achieving monitoring objectives will require monitoring that focuses on different spatial and temporal scales. Spatially, a project might achieve local objectives, but have little or no

measurable effect at larger scales. Temporally, monitoring designs need to consider the amount of time it could take for slowly changing ecological variables to respond to management actions. Additionally, monitoring should be designed to measure the persistence of near-term effects. Larger-scale effects will generally take longer to develop and longer to detect than more localized effects.

Monitoring for large-scale effects can be more difficult than for local effects because the ecological linkages become more complicated as factors outside project boundaries influence processes and biota that affect desired project outcomes. The benefits of improved habitat in one location may be counteracted by degradation at another location, thus showing no overall benefit at large scales. In addition, monitoring at large scales can involve changes in underlying conditions over time or space and be very labor intensive. When possible, specific monitoring and large-scale information needs should be interrelated. In some cases, large-scale monitoring may be just an extension of local monitoring in space and time, but it may also involve designs and procedures that are separate from site-specific monitoring and extend beyond the purview of the project teams.

When possible, specific monitoring and large-scale information needs should be integrated with monitoring efforts that are underway in coastal Louisiana. For example, the CWPPRA produced a program that has been monitoring restoration and protection projects in coastal Louisiana since 1990 (Steyer and Stewart 1992, Steyer et al. 1995). The monitoring program incorporates a system-level wetland assessment component called the Coast-wide Reference Monitoring System (CRMS-Wetlands, Steyer et al. 2003). CRMS-Wetlands provide system-wide performance measures that are evaluated to help determine the cumulative effects of restoration and protection projects in coastal Louisiana. LCA monitoring plans should benefit from existing monitoring networks to the extent practicable and participate in the implementation of CRMS-Wetlands. Such participation can maintain the data consistencies necessary to conduct project assessment and programmatic adaptive management.

4.2. Monitoring Plan for the Amite River Diversion Canal Modification Project

According to the CECW-PB Memo dated 31 August 2009, "Monitoring includes the systemic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits." The following discussion outlines key components of a monitoring plan that will support the LCA Amite River Diversion Canal Modification project Monitoring and Assessment Program.

The plan identifies performance measures along with desired outcomes (i.e. targets) in relation to specific project goals and objectives. A performance measure includes specific feature(s) to be monitored to determine project performance. In addition, if applicable, a risk endpoint was identified. Risk endpoints measure undesirable outcomes of a management or restoration action. A monitoring design was established to determine if the desired outcome or risk endpoint is met.

Upon completion of the Amite River Diversion Canal Modification project, monitoring for ecological success will be initiated and will continue until ecological success is achieved, as defined by the project-specific objectives. This monitoring plan includes the minimum monitoring actions necessary to evaluate success within the project area. Although the law allows for a ten-year cost-shared monitoring plan post construction, ten years of monitoring may not be required. Once ecological success has been achieved, which may occur in less than ten

years post-construction, no further monitoring will be performed. If success cannot be determined within that ten-year period of monitoring, any additional monitoring will be a non-Federal responsibility. This plan estimated monitoring costs for a period of ten years post construction, because that is the maximum allowed Federal contribution to monitoring. As soon as ecological success is achieved, monitoring will cease.

The following discussion outlines key components of a monitoring plan that will support assessment of the project. The plan identifies performance measures along with desired outcomes and monitoring designs in relation to specific project goals and objectives. Additional monitoring is identified as supporting information needs that will help to help further understand and corroborate project effects. The monitoring plan focuses on sampling locations within the project area in order to make decisions regarding project success. Monitoring sites within the study area are also proposed for use as reference sites.

Objective 1: Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients.

Performance Measure 1: Freshwater distribution during operational events

Desired Outcome: Increase hydrologic connectivity and area of extent of freshwater movement into project area above pre-project conditions.

Monitoring Design: Synoptic hydrologic surveys, using salinity, temperature, dissolved oxygen, and velocity as tracers, will be conducted during selected low flow and high flow operational events to track distribution of freshwater. Sampling will be conducted twice annually in the first three years and as required thereafter.

Objective 2: Facilitate natural hydrologic cycles within the study area by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC which would improve tree productivity and seedling germination.

Performance Measure 2a: Swamp vegetation production and extent

Desired Outcome: Increase in basal area increment of baldcypress & tupelo in the swamp from existing conditions (existing conditions defined from pre-construction measurements from CRMS-Wetlands stations and Southeastern Louisiana University historical monitoring)

Monitoring Design: Diameter at breast height (dbh) and overstory tree cover will be measured in the fall in two pre-construction years and four post-construction years (within the first 10 years).

Performance Measure 2b: Number of baldcypress and tupelo saplings

Desired Outcome: A 25% increase in the number of naturally recruited baldcypress and tupelo saplings per acre from pre-project conditions ten years after project implementation. Performance of this measure is most dependent on achieving extended dry periods in the swamp.

Monitoring Design: Understory vegetation (herbaceous, seedling, and sapling) will be measured in the fall in two pre-construction and four post-construction years (within the first 10 years) to assess regeneration and changes in cover classes

Performance Measure 2c: Depth, duration and frequency of flooding in the swamp

Desired Outcome: Increase or decrease from pre-project conditions average flood durations (existing conditions defined from pre-construction measurements from CRMS-Wetlands stations)

Desired Outcome: Maintain dry periods (moist soils) in the swamp for a minimum 7-35 days during summer and early fall for seed germination and maintain water levels below seedling height to promote seedling survival.

Monitoring Design: Water-level recorders will be deployed in six key areas to measure water depths at the needed frequencies. Recorders will be established 3 years prior to construction to determine existing conditions and will be monitored for 10 years post-construction or until desired outcomes are achieved.

Supporting Information Need: A deep rod-surface elevation table (RSET) rod will be installed where hydrologic measurements are taken to establish an elevation benchmark.

Objective 3: Reduce habitat conversion from swamp to marsh and open water within the study area.

Performance Measure 3: Habitat and land:water classification

Desired Outcome: Maintaining immediate pre-construction acreage of baldcypress-tupelo swamp acreage after 10 years.

Monitoring Design: Habitats will be classified using Landsat Thematic Mapper (TM) scenes and Digital Orthophoto Quarter Quadrangles (DOQQs) for one pre- and four post-project years in the study area to assess trends in conversion between swamp, herbaceous marsh, and open water.

Supporting Information Need: Salinity data will be collected in order to characterize potential salinity stress associated with low water conditions in the fall, droughts, and intrusions associated with tropical cyclone events.

Objective 4: Improve fish and wildlife habitat within the study area.

Performance Measure 4: No applicable performance measure

Desired Outcome: Swamp production and hydroperiod measures will be used to assess this objective.

Monitoring Design: Fish and wildlife habitat is linked to the performance measures associated with objectives 1-3, focused on improving habitat. Therefore, no specific monitoring is proposed for this objective.

4.2.1 Monitoring Procedures

The following monitoring procedures will provide the information necessary to evaluate the objectives for the Amite River Diversion Canal Modification project:

Vegetation: Swamp production, regeneration, and mortality will be assessed at 3 locations within the project area and 3 reference locations, twice pre-construction and in four post-construction years. Retention and/or increase of overstory tree cover from pre-project levels will be determined using a spherical densiometer and hemispherical photography techniques as described in the CRMS-Wetlands standard operating procedures manual (Folse et al. 2008).

Densiometer readings and hemispherical photographs will be taken within sampling plots at fixed time intervals. In order to track the growth of trees within the project and reference areas, especially baldcypress and tupelo, all trees (i.e., ≥ 5 cm dbh) within each 20m x 20m sampling plot will be identified to species level, tagged with a numbered aluminum tree tag, and the diameter measured at 4.5 ft above the ground (Folse et al. 2008 and references therein). The dbh of all tagged trees will be measured at regular fixed intervals at which time both "new" trees (i.e., grew to ≥ 5 cm dbh from previous sampling time) and dead trees will also be identified. The dbh data will be used to calculate basal area increment (BAI) which will provide estimates of primary productivity (Megonigal et al. 1997). BAI is the difference in basal area (calculated from dbh) of individual trees between sampling times. The understory (i.e., < 5 cm dbh and 50 cm – 137 cm tall) and herbaceous (i.e., < 5 cm dbh and < 50 cm tall) will be sampled according to Folse et al. (2008) to determine if baldcypress and tupelo are regenerating.

Hydrology: To determine whether the hydrology in the project area is being restored and maintained to that of a natural swamp, water level, salinity, temperature, and dissolved oxygen within the swamp will be measured hourly with datasondes at 3 locations within the project area and at 3 reference locations for three pre-construction years and up to 10 years post-construction. The extent of post-construction hydrology measurements will be dependent upon whether extended dry periods are achieved within initial years following project completion. Each water level gauge will be surveyed relative to the top of the RSET (NAVD88) and will be serviced approximately 9 times per year. Duration and frequency of flooding will be calculated using water levels and the average elevation of the marsh surface. During selected operational events, synoptic hydrologic surveys will be conducted to track distribution of fresh water. Returning the hydroperiod of the project area to that of a typical swamp is essential to decreasing the mortality rate of baldcypress and tupelo trees and increasing biomass and regeneration of these species.

Land:Water and Habitat Classification: Land:water and land cover summaries will be performed on classified Landsat TM scenes for 1985, 1987, 1990, 1998, 1999, 2001, 2002, 2004, 2005, 2006, 2008, 2009, 2010, 2011, and 2012 in the project area. Linear regression will be used to calculate land change trends based on those years, excluding anomalous data. Post-project trends calculated from Landsat TM scenes classified annually will be compared to the pre-project trends to determine whether conversion of swamp to marsh and open water is being reduced in the project area. DOQQs of the project area will need to be flown and habitat analysis completed to capture land cover for one pre-construction and four post-construction years.

4.2.2 Use of Monitoring Results and Analyses

Project monitoring is the responsibility of the OCPR and the USACE. However, because of the need to integrate monitoring for programmatic adaptive management, extensive agency coordination is required. A monitoring workgroup, led by the LCA S&T Program and the USGS, will be responsible for ensuring that project-specific monitoring plans are technically competent and appropriately integrated within a system-wide assessment and monitoring plan.

The results of the monitoring program will be communicated to an Assessment Team that will use the information to assess system responses to management, evaluate overall project performance, and construct project report cards as appropriate.

5.0 DATABASE MANAGEMENT

Database management is an important component of the monitoring plan and the overall adaptive management program. Data collected as part of the monitoring and adaptive management plans for the LCA projects will be archived as prescribed in the "LCA Data Management Strategic" plan developed for the LCA S&T Office, and further developed by the LCA S&T Data Management Working Group.

Data standards, quality assurance and quality control procedures and metadata standards will be prescribed by the LCA S&T Data Management Working Group. Data collected for LCA with similar data types and collection frequencies as those data collected under the CRMS program will be managed by the Louisiana Strategic Online Natural Resources Information System (SONRIS). Pre-existing standard operating procedures built for SONRIS cover issues such as data upload process and format, quality assurance/quality control, and public data release. Storage of all other LCA collected data (spatial or non-spatial) will be handled by the LCA project-specific data libraries on http://www.LCA.GOV.

Where applicable, Open Geospatial Consortium standards will be used to facilitate data sharing among interested parties. Data analysis and reporting responsibilities will be shared between project assessment and adaptive management efforts in order to provide Amite River Diversion Channel Modification project reports for the LCA Program Management Team.

5.1 Description and Location

The data management plan should identify the computing hardware and any specialized or custom software used in data management for an adaptive management program. Opportunities exist to develop either a centralized or distributed data management system. The data managers, with input from the Adaptive Management Planning Team, should determine which approach best suits the needs of the overall adaptive management program.
Individuals with responsibility for data management activities (data managers) in support of project assessment should be identified. The data managers should collaborate with the LCA Adaptive Management Planning Team in developing a data management plan to support project assessment.

5.2 Data Storage and Retrieval

Data collected as part of the monitoring and adaptive management plans for the LCA projects will be archived as prescribed in the "LCA Data Management Strategic Plan" developed for the LCA S&T Office, and further developed by the Data Management Working Group.

Data standards, quality assurance and quality control procedures and metadata standards will be prescribed by the Data Management Working Group, and will be complementary with the CRMS-Wetlands program and SONRIS database. Data will be served using a map services tool, similar to that currently employed by the CRMS-Wetlands project.

5.3 Analysis, Summarizing, and Reporting

Data analysis and reporting responsibilities will be shared between project assessment and programmatic adaptive management efforts in order to provide reports for the Amite River Diversion Canal Modification project assessment team, project managers, and decision-makers.

6.0 ASSESSMENT

The assessment phase of the framework describes the process by which the results of the monitoring efforts will be compared to the desired project performance measures and/or acceptable risk endpoints (i.e., decision criteria) that reflect the goals and objectives of the management or restoration action. The assessment process addresses the frequency and timing for comparison of monitoring results to the selected measures and endpoints. The nature and format (e.g., qualitative, quantitative) of these comparisons are defined as part of this phase. The resulting methods for assessment should be documented as part of the overall monitoring and assessment plan.

The results of the Amite River Diversion Canal Modification project monitoring program will be regularly assessed in relation to the desired project outcomes as described by the previously specified project performance measures. This assessment process continually measures the progress of the project in relation to the stated project goals and objectives. The assessments will continue through the life of the project or until it is decided that the project has successfully achieved its goals and objectives.

6.1 Assessment Process

The Assessment Team assigned to the Amite River Diversion Canal Modification project will utilize a combination of qualitative (i.e., professional judgment) and quantitative methods for comparing the values of the performance measures produced by monitoring with the selected values of these measures that define criteria for decision making.

The appropriate statistical comparisons (e.g., hypothesis testing, ANOVA, multivariate methods, etc.) will be used to summarize monitoring data as they are obtained and compare these data summaries with the project decision criteria. These continued assessments will be documented as part of the project reporting and data management system.

6.2 Variances and Success

The project Assessment Team will collaborate with project managers and decision-makers to define magnitudes of difference (e.g., statistical differences, significance levels) between the values of monitored performance measures and the desired values (i.e., decision criteria) that will constitute variances. Meaningful comparisons between monitoring results and desired performance will require characterization of historical and current spatial-temporal variability that define baseline conditions. Variances (or their absence) will be utilized to evaluate trajectories of change within the project area.

Conceptual models have been developed for each project describing the linkages between stressors and performance measures. The assessments will help determine if the observed responses are linked to the project. Each project has been formulated to address as many system stressors as feasible. If the stressors targeted by the project have changed and the performance measure has not, the linkages in the conceptual model should be examined to determine what other factors may be influencing the performance measure response.

The assessments will also determine if the responses are undesirable (e.g., are moving away from restoration goals) and if the responses have met the success criteria for the project. If performance measures are not responding as desired because the stressor has not changed enough in the desired direction, then recommendations should be made concerning modifications

to the project. If the stressor has changed as expected/desired and the performance measure has not, additional research may be necessary to understand why.

From a system-wide perspective, scientific and technical information would be generated from the implementation of a system–wide monitoring effort. Information generated from this effort should be linked to evaluation of LCA performance and system response. From a project-level perspective, monitoring plans should be designed to inform adaptive management decision-making by providing monitoring data that are relevant to addressing uncertainty.

Similarly, for multiple performance measures and corresponding monitoring results, the Assessment Team will determine the number and magnitude of variances within a single assessment that will be required to execute any of the above stated recommendations.

6.3 Frequency of Assessments

Ideally, the frequency of assessments for the Amite River Diversion Canal Modification project would be determined by the relevant ecological scales of each performance measure. The project's technical support staff will identify for each performance measure the appropriate timescale for assessment. The project should have a combination of short-, medium-, and long-term performance measures. Assessments should be performed at a five year interval at a minimum; however, depending on the timescale of expected responses of the specific measure and frequency of data collection, it may be determined during PED that more frequent reporting may be necessary.

6.4 Documentation and Reporting

The Assessment Team will document each of the performed assessments and communicate the results of its deliberations to the managers and decision-makers designated for the Amite River Diversion Canal Modification project. The Assessment Team will work with the project monitoring team and monitoring workgroup to produce an annual Amite River Diversion Canal Modification project report card that will measure progress towards project goals and objectives as characterized by the selected performance measures. The results of the assessments will be communicated regularly to the project managers and decision-makers.

7.0 PROJECT CLOSE-OUT

Close-out of the project would occur when it is determined that the project objectives have been attained or when the maximum ten-year monitoring period has been reached. Success would be considered to have been achieved when the following objectives have been met, or when it is clear that they will be met based upon the trends for the site conditions and processes:

- Pre- and post-construction comparison of survival rates of regenerated species
- Hydrologic connectivity
- Swamp regeneration

There may be issues related to the sustainability of the project that would require some monitoring and management beyond achieving these objectives. Due to the variable nature of the Louisiana coastal zone, the monitoring baseline may change during the period of analysis. Consequently, it may be appropriate to consider extending project-specific monitoring and adaptive management beyond ten years.

8.0 COSTS FOR IMPLEMENTATION OF MONITORING AND ASSESSMENT PROGRAM

The costs associated with implementing the LCA monitoring and adaptive management plans were estimated based on currently available data and information developed during plan formulation as part of the feasibility study. Because uncertainties remain as to the exact project features and monitoring and assessment elements, the costs estimated in Table 1 (below) will be refined in the PED phase during the development of the detailed monitoring and assessment plan.

8.1 Costs for Implementation of Monitoring Program

Costs to be incurred during the PED phase include monitoring site construction and establishment and two years of pre-construction and construction data acquisition that establish baseline conditions. Cost calculations for post-construction monitoring are displayed as annual costs and as a ten year (maximum) total. If ecological success is determined earlier (prior to ten years post construction), the monitoring program will cease and costs will decrease accordingly.

It is intended that monitoring conducted under the LCA program will utilize centralized data management, data analysis, and reporting functions. All data collection activities follow consistent and standardized processes regardless of the organization responsible for monitoring. Cost estimates include monitoring equipment, monitoring station establishment, data collection, quality assurance/quality control, data analysis, assessment, and reporting for the proposed monitoring elements in Table 1 below. These estimates account for a 2.6% annual inflation rate, adopted from the CWPPRA Program. The current total estimate for implementing the monitoring and assessment program for this project is $2,971,200. Unless otherwise noted, costs will begin at the onset of the PED phaseand will be budgeted as construction costs.

Table 1. Preliminary Cost Estimates for Implementation of the Monitoring and Assessment Program for the LCA Amite River Diversion Canal Modification Project (Alt. 33).

Category	Activities	1 yr PED Set-up & Data Acquisition	1 yr Construction	10 yr Post-Construction	Total
Monitoring: planning and management	Monitoring workgroup, drafting detailed monitoring and assessment plan during PED, working with PDT on performance measures	$119,000	$16,800	$194,500	$330,300
Monitoring: data collection	Landrights, site construction, and surveying	$80,800			$80,800
	Vegetation	$20,000	$28,700	$94,900	$143,600
	Hydrology	$70,700	$72,500	$837,500	$980,700
	Land:Water	$6,700	$6,800	$79,000	$92,500
	Habitat classification	$16,400		$77,900	$94,300
	Water quality	$13,500	$13,900	$160,500	$187,900
Database Management	Database development, management, and maintenance; webpage development for communication of data to stakeholders	$20,500	$21,100	$243,100	$284,700
Assessment				$243,100	$243,100
TOTAL		**$420,800**	**$193,400**	**$2,357,000**	**$2,971,200**

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ANNEX 1. LCA Amite River Diversion Canal Modification Project
Conceptual Ecological Model

1.0 INTRODUCTION

1.1 Conceptual Ecological Model Definition

Although the term "conceptual ecological model" (CEM) may be applied to numerous disciplines, CEMs are generally simple, qualitative models, represented by a diagram, that describe general functional relationships among the essential components of an ecosystem. CEMs typically document and summarize current understanding of, and assumptions about, ecosystem function. When applied specifically to ecosystem restoration projects, CEMs also describe how restoration actions propose to alter ecosystem processes or components to improve system health (Fischenich 2008). To describe ecosystem function, a CEM usually diagrams relationships between major anthropogenic and natural stressors, biological indicators, and target ecosystem conditions.

1.2 Purpose and Functions of Conceptual Ecological Models

CEMs can be particularly helpful with the Louisiana Coastal Area (LCA) Program and its projects by providing assistance with four important tasks: ecosystem simplification; communication; plan formulation;, and science, monitoring, and adaptive management.

1.2.1 Ecosystem Simplification

Because natural systems are inherently complex, resource managers must utilize tools that simplify ecosystem relationships and functions within the target ecosystem. An understanding of the target ecosystem is paramount to planning and constructing effective ecosystem restoration projects. During CEM development, knowns and unknowns about the connections and causalities in the systems are identified and delineated (Fischenich 2008).

CEMs can promote ecosystem simplification through the following processes:

- Organization of existing scientific information;
- Clear depiction of system components and interactions;
- Promotion of understanding of the ecosystem;
- Diagnosis of underlying ecosystem problems;
- Isolation of cause and effect relationships; and
- Identification of species most likely to demonstrate an ecosystem response.

1.2.2 Communication

CEMs are an effective tool for the communication of complex ecosystem processes to a large diverse audience (Fischenich 2008). It is vitally important that project teams understand ecosystem function in order to realistically predict accomplishments to be achieved by restoration projects. CEMs can facilitate effective communication between project team members about ecosystem function, processes, and problems, and can assist in reaching consensus within the project team on project goals and objectives.

Because CEMs summarize relationships among the important attributes of complex ecosystems, they can serve as the basis for sound scientific debate. Stakeholder groups, agency functions

(e.g., planning and operations), and technical disciplines typically relate to systems resource use and management independently, but CEMs can be used to link these perspectives.

The process of model development is at least as valuable as the model itself and affords an opportunity to draw fresh insight as well as address unique concerns or characteristics for a given project. Workshops to construct CEMs are brainstorming sessions that explore alternative ways to compress a complex system into a small set of variables and functions. This interactive process of system model construction facilitates communication between project team members and almost always identifies inadequately understood or controversial model components.

CEMs can promote communication by facilitating the following:

- Integrating input from multiple sources and informing groups of the ideas, interactions, and involvement of other groups (Fischenich 2008);
- Assembling project/study managers with the project team and stakeholders to discuss ecosystem condition, problems, and potential solutions;
- Synthesizing current understanding of ecosystem function;
- Developing consensus on a working set of hypotheses that explain habitat changes;
- Developing consensus on indicators that can reflect project specific ecological conditions; and
- Establishing a shared vocabulary among project participants.

1.2.3 Plan Formulation

Formulating a plan for an effective ecosystem restoration project requires an understanding of the following elements:

1. The underlying cause(s) of habitat degradation;
2. The manner in which causal mechanisms influence ecosystem components and dynamics; and
3. The manner in which intervening with a restoration project may reduce the effects of degradation.

These three elements should form the basis of any CEM applied to project formulation (Fischenich 2008).

CEMs can provide valuable assistance to the plan formulation process through the following:

- Supporting decision-making by assembling existing applicable science;
- Assisting with formulation of project goals and objectives, indicators, management strategies, and results;
- Providing a common framework among team members from which to develop alternatives;
- Supplementing numerical models to assess project benefits and impacts; and
- Identifying biological attributes or indicators that should be monitored to best interpret ecosystem conditions, changes, and trends.

1.2.4 Science, Monitoring, and Adaptive Management

Through the recognition of important physical, chemical, or biological processes in an ecosystem, CEMs identify aspects of the ecosystem that should be measured. Hypotheses about uncertain relationships or interactions between components may be tested and the model may be revised through research and/or an adaptive management process. Indicators for this process may occur at any level of organization, including the landscape, community, population, or genetic levels; and may be compositional (i.e., referring to the variety of elements in a system), structural (i.e., referring to the organization or pattern of the system), or functional (i.e., referring to ecological processes) in nature.

CEMs can be helpful in restoration science, monitoring, and adaptive management through the following:

- Making qualitative predictions of ecosystem response;
- Identifying possible system thresholds that can warn when ecological responses may diverge from the desired effect;
- Outlining further restoration and/or research and development needs;
- Identifying appropriate monitoring indicators and metrics;
- Providing a basis for implementing adaptive management strategies;
- Interpreting and tracking changes in project targets;
- Summarizing the most important ecosystem descriptors, spatial and temporal scales, and current and potential threats to the system;
- Facilitating open discussion and debate about the nature of the system and important management issues;
- Determining indicators for monitoring;
- Helping interpret monitoring results and explore alternative courses of management;
- Establishing institutional memory of the ideas that inspired the management and monitoring plan;
- Forecasting and evaluating effects on system integrity, stress, risks, and other changes;
- Identifying knowledge gaps and the prioritization of research;
- Interpreting and monitoring changes in target indicators; and
- Assisting in qualitative predictions and providing a key foundation for the development of benefits metrics, monitoring plans, and performance measures.

1.2.5 Limitations of Conceptual Ecological Models

CEMs cannot identify the most significant natural resources within the target ecosystem or prioritize project objectives. They do not directly contribute to the negotiations and trade-offs common to ecosystem restoration projects. CEMs are not *The truth*, but are simplified depictions of reality. They are not *Final*, but rather provide a flexible framework that evolves as understanding of the ecosystem increases. CEMs are not *Comprehensive* because they focus only

upon those components of an ecosystem deemed relevant while ignoring other important (but not immediately germane) elements. CEMs do not, in and of themselves, quantify restoration outcomes, but identify indicators that can be monitored to determine responses within the target ecosystem to restoration outputs.

Good conceptual models effectively communicate which aspects of the ecosystem are essential to the problem, and distinguish those outside the control of the implementing agency. The best conceptual models focus on key ecosystem attributes, are relevant, reliable, and practical for the problem considered, and communicate the message to a wide audience.

1.3 Types of Conceptual Ecological Models

CEMs can be classified according to both their composition and their presentation format. They can take the form of any combination of narratives, tables, matrices of factors, or box-and-arrow diagrams. The most common types of CEMs are narrative, tabular, matrix, and various forms of schematic representations. A comprehensive discussion of these types of CEMs is provided in Fischenich (2008). Despite the variety in types of CEMs, "no single form will be useful in all circumstances" (Fischenich 2008). Therefore, it is of vital importance to establish the specific plan formulation needs to be addressed by the CEM, and develop the CEM accordingly because "[c]onceptual models . . . are most useful when they are adapted to solve specific problems" (Fischenich 2008).

1.3.1 Application of Conceptual Ecological Models to LCA Projects

CEMs have been widely used in other regions of North America when planning large-scale restoration projects (Barnes and Mazzotti 2005). The LCA team has decided to utilize the Ogden model (Ogden and Davis 1999). Like the plan formulation process, the LCA team recognizes that CEM development is likely to be an iterative process, and that CEMs developed for LCA projects during early plan formulation may be dramatically changed before project construction.

1.3.2 Model Components

The CEM utilized for LCA projects follows the top-down hierarchy of information using the components established by Ogden and Davis (1999). The schematic organization of the CEM is depicted in Figure 1 and includes the following components:

- *Drivers*- This component includes major external driving forces that have large-scale influences on natural systems. Drivers may be natural (e.g., eustatic sea level rise) or anthropogenic (e.g., hydrologic alteration) in nature.
- *Ecological Stressors*- This component includes physical or chemical changes that occur within natural systems, which are produced or affected by drivers and are directly responsible for significant changes in biological components, patterns, and relationships in natural systems.
- *Ecological Effects*- This component includes biological, physical, or chemical responses within the natural system that are produced or affected by stressors. CEMs propose linkages between one or more ecological stressors and ecological effects and attributes to explain changes that have occurred in ecosystems.

- *Attributes*- This component (also known as indicators or end points) is a frugal subset of all potential elements or components of natural systems representative of overall ecological conditions. Attributes may include populations, species, communities, or chemical processes. Performance measures and restoration objectives are established for each attribute. Post-project status and trends among attributes are measured by a system-wide monitoring and assessment program as a means of determining success of a program in reducing or eliminating adverse effects of stressors.
- *Performance measures*- This component includes specific features of each attribute to be monitored to determine the degree to which attribute is responding to projects designed to correct adverse effects of stressors (i.e., to determine success of the project).

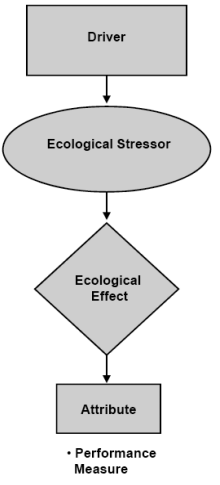


Figure 1. Conceptual Ecological Model Schematic Diagram.

This CEM does not attempt to explain all possible relationships or include all possible factors influencing the performance measure targets within natural systems in the study area. Rather, the model attempts to simplify ecosystem function by containing only information deemed most relevant to ecosystem monitoring goals.

2.0 CONCEPTUAL ECOLOGICAL MODEL DEVELOPMENT

2.1 Methodology

A CEM was developed for the Amite River Diversion Canal Modification project by members of the interagency Project Delivery Team. The creation of this CEM was an interactive and iterative process. Prior to model development, the project team reviewed existing information on the ecosystem within the study area. A small team meeting was then convened to identify and discuss causal hypotheses that best explain both natural and key anthropogenically-driven alterations in the study area. A list of appropriate stressors and consequent ecological effects in the study area ecosystem was developed from these discussions. Additionally, a series of attributes was identified that exhibited characteristics that ideally suited them to serve as key indicators of project success through the measurement and analysis of assessment performance measures associated with these attributes. The project team used these hypotheses and lists of components to develop an initial draft of the model and to prepare a supporting narrative document to explain the organization of the model and science supporting the hypotheses.

Additional information about the components of this CEM is presented below.

2.2 PROJECT BACKGROUND

The Amite River Diversion Canal Modification project was identified as a near-term critical feature in the *Louisiana Coastal Area (LCA),Louisiana - Ecosystem Restoration Study* (2004 LCA Plan) (USACE 2004a). The 2004 LCA Plan was recommended to the Congress by a Chief of Engineers report dated January 31, 2005, which recommended a coordinated, feasible solution to the identified critical water resource problems and opportunities in coastal Louisiana. The Amite River Diversion Canal Modification project was included in that plan along with near-term critical restoration features throughout coastal Louisiana. Including the Amite River Diversion Canal Modification project, 10 additional projects were recommended for further studies, in anticipation that such features would be subsequently recommended for future Congressional authorization. The 2004 LCA Plan was developed by the State of Louisiana and the United States Army Corps of Engineers (USACE) in order to implement some of the restoration strategies outlined in the 1998 report *Coast 2050: Toward a Sustainable Coastal Louisiana*.

The purpose of this study is to investigate the feasibility of restoring baldcypress-tupelo swamp habitat near the Amite River Diversion Canal by constructing gaps in the spoil banks that border the canal. This Feasibility Study is authorized by the 2004 LCA Plan and the 2007 Water Resources Development Act (WRDA 2007), which requires the completion of a Feasibility Study and the incorporation of the study findings into a signed Chief of Engineers Report, which must be submitted to Congress by the Secretary of the Army by December 31, 2010.

Pursuant to the completion of this Feasibility Study, a CEM was developed to establish causal hypotheses that best explain the major alterations in the natural systems within the study area, to identify attributes of the natural system that are likely to exhibit a response to project features, and to identify performance measures that can be monitored following project implementation to determine the degree of project success with respect to countering or correcting the natural system alterations.

2.2.1 Project Goals and Objectives

The goal of the Amite River Diversion Canal Modification project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, so as to contribute toward achieving

and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

The objectives of the project include the following:

- Prevent habitat conversion and future land loss;
- Establish hydrologic connectivity to allow seasonal drying in which the swamps are drained to promote seedling germination, establishment, and survival;
- Introduce nutrients and sediment to swamps;
- Promote water circulation to improve water quality (including salinity reduction);
- Increase swamp vegetation productivity;
- Restore and preserve fish and wildlife habitat; and
- Protect vital socioeconomic resources including cultures, community, infrastructure, business and industry, and flood protection features.

2.2.2 Project Description

The study area is located in LCA Subprovince 1 in Livingston and Ascension parishes, in the vicinity of Head of Island, Louisiana, encompassing portions of Louisiana's Sixth and Third Congressional Districts (Figure 2). The study area contains approximately 19,000 acres of baldcypress-tupelo swamp habitat in the western Maurepas Swamp. The study area includes the Amite River Diversion Canal, a 10.6-mile-long flood control channel between the Amite and Blind rivers. Dredged material excavated during channel construction was deposited in spoil banks on either side of the canal. These spoil banks have disrupted the natural hydrologic regime in the study area. Prior studies have documented degradation in the baldcypress-tupelo swamp adjacent to the diversion canal and have demonstrated a need for ecosystem restoration of this swamp habitat through the reintroduction of a natural hydrologic regime. The proposed project involves restoration of impaired swamp habitat within the study area by gapping the spoil banks along the diversion canal to promote hydrologic exchange between flows within the diversion canal and the adjacent swamp habitat. Gapping the banks of other waterbodies and a relict railroad grade that transects the study area were also evaluated as part of the proposed project.

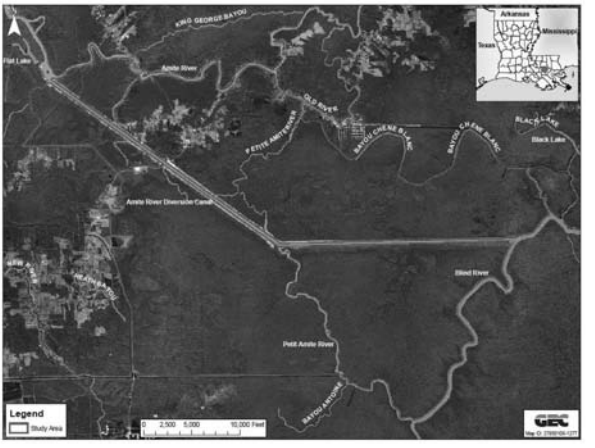


Figure 2. Amite River Diversion Canal Modification Project Study Area.

3.0 CONCEPTUAL ECOLOGICAL MODEL DISCUSSION

The CEM developed for the Amite River Diversion Canal Modification project is presented in Figure 3. Model components are identified and discussed in the following subsections.

3.1 Drivers

3.1.1 Canal Construction

The Amite River Diversion Canal is a 10.6-mile-long channel that extends from the Amite River at Mile 25 to Mile 4.8 of the Blind River. Construction of the canal was authorized by Senate Report No. 1029 (89th Congress, 1st Session), which authorized construction of improvements on the Amite and Comite rivers and Bayou Manchac, Louisiana, in the interest of flood control and major drainage. The canal was constructed in accordance with provisions of the U.S. Army Corps of Engineers (USACE) New Orleans District publication *Survey of Amite River and Tributaries, Louisiana* (USACE 1955), which was conducted under the authority of the Flood Control Act of 1944. The survey report recommended the construction of a diversion channel for the Amite River with a length of 10 miles, extending from Mile 25 of the Amite River to Mile 5 of the Blind River. Construction of the Amite River Diversion Canal was completed in October 1963. Dredged spoil generated in the construction of the canal was placed in two spoil banks on either side of the canal. These spoil banks form topographic high points within the study area.

Because of an inadequate understanding of the natural systems operating within the study area, construction of the Amite River Diversion Canal has had unforeseen, adverse environmental effects. Canal construction has altered physical defining characteristics, including water storage, sheet flow, and nutrient and sediment input levels within the baldcypress-tupelo swamp habitat in the study area.

3.1.2 Hurricanes

Coastal storms, particularly tropical cyclone events, also exert a stochastic but severe influence on the study area. Data obtained from the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center indicate that the storm centers of at least 14 tropical cyclones with a Saffir-Simpson Hurricane Scale of Category 2 or higher have passed within 50 miles of the study area during the interval 1851-2007, and at least 52 such tropical cyclones have passed within 100 miles of the study area during the same interval. The most recent tropical cyclones to affect the study area were hurricanes Katrina and Rita, which occurred in August 2005 and September 2005, respectively, and hurricanes Gustav and Ike, which occurred in September 2008.

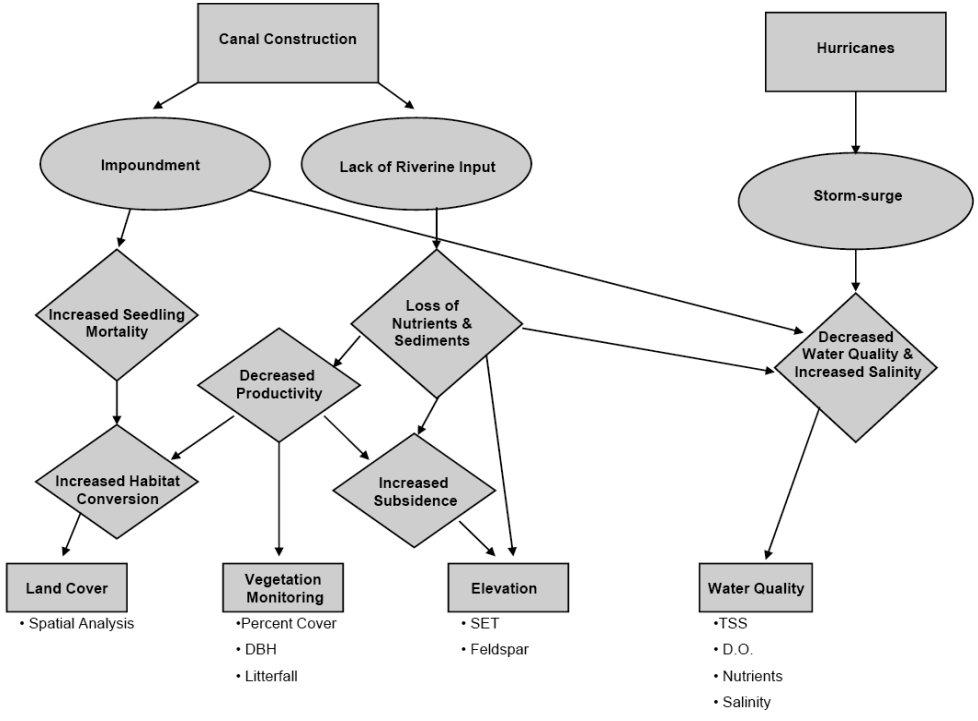


Figure 3. Conceptual Ecological Model, LCA Amite River Diversion Canal Modification Project.

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Principal impacts to the study area as a result of tropical cyclone events are windfall mortality and storm surges originating from Lake Maurepas. Windfall mortality typically exerts the greatest impact upon mature or diseased trees, sparing younger, healthier specimens. Storm surges exert a considerably greater and more widespread stress upon vegetation through the introduction of storm surge waters that exhibit higher salinity concentrations than are present in surface waters within the study area. The four hurricanes identified above each resulted in measurable storm surges within the study area. Water gage data collected from a U.S. Geological Survey (USGS) monitoring station on the Amite River at Louisiana Highway (LA-) 22 and from Louisiana Department of Natural Resources (LDNR) gages established in the eastern study area in 2005 recorded storm surges from hurricanes Katrina and Rita that inundated the Amite River Diversion Canal within the study area at an average of 2.0 and 3.3 feet above mean annual water level, respectively. Water gage data collected from the USGS monitoring station on the Amite River at LA-22 recorded storm surges from hurricanes Gustav and Ike within the study area at an average of 3.2 and 4.4 feet above the 2007 mean annual water level, respectively.

3.2 Ecological Stressors

3.2.1 Impoundment

The placement of dredged material in spoil banks along either side of the Amite River Diversion Canal disrupted sheet flow within the study area and formed topographic high points that prevented the drainage of baldcypress-tupelo swamps into waterbodies within the study area during intervals of low surface flow. This activity, in conjunction with the construction of other features, such as the relict logging railroad grade that traverses the eastern study area from north to south, resulted in the permanent impoundment of baldcypress-tupelo swamp habitat within the study area.

Swamp impoundment is particularly pronounced in the eastern portion of the study area (i.e., east of the Petite Amite River), as demonstrated by hydrograph data collected in 2005 in this area for a Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) project nominee for the Priority Project List (PPL) 16, *Hydrologic Restoration in the Swamps West of Lake Maurepas*. Approximately 11 months of water gage data were collected in the eastern study area from three water gages that were set within the Amite River Diversion Canal and inundated swamp habitat on the left descending bank. The results of this data collection analysis, as presented in Shaffer et al. (2006), indicate that the swamp habitat along the left descending bank of the diversion canal in the eastern study area is impounded; water levels within this area never receded below 2.2 feet above mean sea level (msl), including periods in which water levels within the canal receded below that level.

Impoundment within the study area has resulted in decreased water quality and increased seedling mortality, which in turn has resulted in increased habitat conversion to marsh and open water (see Section 3.3 for additional discussion).

3.2.2 Lack of Riverine Input

Historically, hydrologic conditions within the study area were dominated in the north and west by the Amite River, in the south by overbank flow from the Mississippi River, and in the east by tidal influence from Lake Maurepas. Periodic flooding of the Amite and/or Mississippi rivers resulted in the inundation of baldcypress-tupelo habitat within the study area. Flooding occurred

within the study area and vicinity on a cyclical basis, with peak water elevations in the late spring or early summer. As floodwaters receded, surface waters in the study area were conveyed eastward via sheet flow until they were received by Bayou Chene Blanc or the Blind River, by which they were conveyed to Lake Maurepas.

The implementation of flood control projects from the early to mid-20th century, including the channelization of the Amite River, construction of flood protection levees on the Mississippi River, and especially the construction of the Amite River Diversion Canal, disrupted the natural hydrologic regime within the study area. River channelization and levee construction greatly reduced overbank flooding in the study area, causing a loss of nutrients and sediments in the ecosystem, decreased water quality, and increased subsidence (see Section 4.3 for additional discussion).

3.2.3 Storm Surge

Tropical cyclone events exert a stochastic but severe stress upon the swamp habitat through salinity spikes associated with saline storm surge events (see Section 3.3 for additional discussion). The introduction of saline storm surge water into the impounded swamps results in reduced biomass production and impaired health, which in turn causes increased tree mortality, decreased soil production and integrity, and a consequent increase in relative subsidence (see Section 3.3 for additional discussion). Periodic influxes of saline storm surge waters remain trapped in the impounded swamps, resulting in stochastic but periodic cumulative increases in salinity in impounded waters and soils in the study area. Saline storm surge waters become impounded in the swamp by the spoil banks that border the Amite River Diversion Canal and is not allowed to drain out the swamps during seasonal low flow events or to be flushed out by seasonal river bank overflow events. Saltwater introduction into formerly freshwater wetlands has been demonstrated to reduce photosynthetic rates of baldcypress and water tupelo and reduce productivity of swamp forest tree species and other freshwater vegetation.

3.3 Ecological Effects

3.3.1 Increased Seedling Mortality

Increased seedling mortality is a biological response to the impoundment produced in the study area by the spoil banks that border the Amite River Diversion Canal (see Section 4.2.1). Seedling germination and establishment is an essential component for ensuring the sustainability of baldcypress-tupelo swamp habit through the replacement of trees lost to windfall mortality or disease. However, baldcypress and tupelo seedling establishment is currently impaired within the study area as a result of the persistent flooding conditions that result from impoundment (CWPPRA Task Force 2002).

Souther and Shaffer (2000) reported that in the early 20th century, baldcypress swamps were harvested *en masse* in coastal Louisiana, and that in many harvested areas, natural regeneration did not occur; instead, these areas converted to marsh or open water. The study concluded that prolonged flooding or complete submergence within the swamps may have suppressed germination or growth rates of young seedlings and even caused mortality (see Section 3.3.1). Neither baldcypress nor tupelo seeds can germinate when flooded (Hamilton and Shaffer 2001). Seeds of both species remain viable when submerged in water and can germinate readily when floodwaters recede (Kozlowski 1984). However, the seedlings require seasonal drying periods,

and the substrate compaction associated with these drying periods, for their root systems to become properly established in the swamp substrate. With minimal ability to drain and persistent flooding, the typical seasonal drying of the swamp does not usually occur, leading to failure of seedlings to establish themselves and replace older trees that have been lost to other natural processes (CWPPRA Task Force 2002).

3.3.2 Loss of Nutrients and Sediments

Loss of nutrients and sediments is a physical response to the lack of riverine input caused by the construction of the Amite River Diversion Canal (see Section 3.2.2). Effler et al. (2006) examined the importance of nutrient influxes that accompany freshwater diversions or other hydrologic connectivity projects to swamp productivity. Nutrient augmentation of baldcypress and tupelo trees in the Maurepas Swamp (similar to nitrate loading rates expected from a small freshwater diversion) increased radial growth of both species (especially baldcypress) in degraded forest stands. Nutrient augmentation also increased nitrogen in foliage for both tree species. These findings support hypotheses that swamps in southeastern Louisiana are nutrient-limited, and existing trees can utilize, benefit, and act as nutrient sinks for nutrient-laden river water accompanying diversions.

Further evidence of nutrient starvation within the study area was identified in Shaffer et al. (2001). This study determined the nutrient augmentation significantly enhanced (by about 33 percent) biomass production of herbaceous vegetation at monitoring stations within the western Maurepas Swamp during 2000. Furthermore, several studies conducted over the last decade have demonstrated that nutrient augmentation to baldcypress seedlings doubles growth rates in the western Maurepas Swamp (Boshart 1997, Forder 1995, Greene 1994, Myers et al. 1995), further indicating that the baldcypress-tupelo swamp in the study area and vicinity is nutrient-limited.

Shaffer et al. (2008) presented data at the Society of Wetland Scientists meeting on tree growth in the Maurepas Swamp. For the period 2000-2007, diameter growth was measured for over 1,800 trees. Diameter growth in the measured trees was significantly less than established growth levels for trees in healthy freshwater swamp systems. The study determined that in interior swamp locations such as the study area, the primary factor inhibiting diameter growth was nutrient-poor stagnant standing water and the lack of nutrient-rich freshwater throughput caused by the loss of hydrologic connectivity with riverine systems.

3.3.3 Decreased Water Quality and Increased Salinity

Decreased water quality and increased salinity is a chemical response to both the impoundment produced in the study area by the spoil banks that border the Amite River Diversion Canal (see Section 3.2.1) and the introduction of saline storm surge waters associated with tropical cyclone events (see Section 3.2.3). The Maurepas Swamp is characterized by nutrient-poor surface waters. Day et al. (2001) conducted a water quality analysis in support of CWPPRA Project PO-29 *Mississippi River Reintroduction into Maurepas Swamp*. The observed concentrations of nitrate, ammonium, and nitrogen at surface water sampling stations within the western Maurepas Swamp were all reduced with respect to observed concentrations in the Mississippi River. The results of sampling of water quality parameters shows that for some nutrient forms, the Maurepas basin has relatively low nutrient concentrations compared to the Mississippi River and other systems studied. The results of this study indicate that the baldcypress-tupelo swamp within the study area and vicinity is severely nutrient-limited.

In addition, the trees are highly stressed, which appears to decrease productivity, increase mortality, and increase susceptibility to herbivory and parasites. Saltwater intrusion has increased in this general area, at least in part due to a combination of net subsidence and the lack of riverine freshwater inputs. Saltwater intrusion events observed in the western Maurepas Swamp in 1999 and 2000 caused greater than 97 percent mortality in planted baldcypress seedlings in the northwestern portion of the swamp (USACE 2004a). Salinity of three parts per thousand (ppt) can reduce growth of both baldcypress and tupelo saplings (Pezeshki 1990); and when combined with flooding stress, growth reduction in baldcypress was substantial. Clearly salinity can be a significant factor contributing to swamp deterioration, especially combined with other stressors (e.g., flooding, herbivory). Low-salinity water has been noted in the swamps north and south of the Amite River Diversion Canal (CWPPRA Task Force 2002).

The western Maurepas Swamp is characterized by saltwater intrusions that occur mostly during low-water periods in the fall (Shaffer et al. 2001). The mean salinity of the lake water measured at the Manchac Bridge also has increased gradually since 1951 (Thomson 2000), indicating that salinity levels appear to be increasing in the region. Additionally, storm surges originating from Lake Maurepas associated with tropical cyclone events exert a stochastic but severe stress upon the swamp habitat through salinity spikes in surface waters within the swamp. Recent tropical cyclone events, occurring at a rate of one to two per year, have produced measurable spikes in salinity within the western Maurepas Swamp (USACE 2004a). These salinity spikes are in turn exacerbated by the impoundment produced within the study area by the spoil banks that border the Amite River Diversion Canal. The CWPPRA PPL 12 Environmental Work Group concluded that the spoil banks appeared to restrict the ability of higher salinity water to be flushed from the system once it finds its way in (CWPPRA Task Force 2002). Storm surge waters currently remain trapped in the impounded swamps, resulting in stochastic but periodic cumulative increases in salinity in impounded waters and soils in the study area.

3.3.4 Decreased Productivity

Decreased productivity in vegetative communities in the study area is a biological response to the lack of riverine input caused by the construction of the Amite River Diversion Canal and the consequent loss of nutrients and sediments (see Sections 3.2.2 and 3.3.2). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing levels of productivity in the Maurepas Swamp are as low as 50 percent or even 25 percent of average values.

As part of the CWPPRA PPL 11 effort to launch a project diverting Mississippi River water into the Maurepas Swamp, Shaffer et al. (2001) examined woody and herbaceous vegetation at 20 study sites, each with two 625-square-meter (m^2) permanent stations, in the southern Maurepas Swamp, including several along the Amite River Diversion Canal near its eastern terminus. Within each of the forty 25-meter by 25-meter (625 m^2) permanent stations, four 4-meter by 4-meter (16 m^2) permanent herbaceous plots were established. Cover values were obtained by two independent estimates for all 160 plots from mid-June to early July and again in early September of 2000. To measure annual production, herbaceous (understory) primary productivity was estimated within one fertilized and one unfertilized herbaceous (4-meter by 4-meter) plot by clipping two randomly chosen (non-repeating) replicate subplots (of 0.25 m^2 area) twice during the growing season. Tree health and primary productivity were determined through the collection of annual litter. Annual tree diameter growth was measured to estimate wood production and calculate basal wood area per hectare of swamp. The measured tree diameters in each plot were

then converted into basal wood area, summed and multiplied by 16 (as there are sixteen 625-m^2 plots to a hectare) to estimate the total area of basal wood per hectare for each plot for each of the 40 stations. Five litter traps were randomly installed at each of two 625-m^2 plots at 40 stations throughout the Maurepas Swamp, yielding a total of 200 litter traps deployed. The study concluded that salinity is an important stressor in the Maurepas Swamp, but that degradation of tupelo trees within the swamp has been occurring for decades and is almost certainly primarily due to altered hydrology and lack of throughput. The study determined that the low soil bulk densities and high soil organic matter content throughout much of this swamp are indicative of a lack of riverine influence. The results of the study indicated that all measures of ecosystem health collected in the southern Lake Maurepas region indicate that these swamps are highly degraded and would benefit from a substantial infusion of nutrients and freshwater from a river diversion. One drawback of this study, however, is that data were collected during the drought years of the late 20th and early 21st centuries, and may therefore be atypical of normal baseline conditions and responses to flooding of the swamp.

Results of studies in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 300 to 500 percent (Rybczyk et al. 2002, Hamilton and Shaffer 2001).

3.3.5 Increased Habitat Conversion

Increased habitat conversion to marsh and open water is a physical and biological response to both impoundment and the resulting increased seedling mortality (see Sections 3.2.1 and 3.3.1) and lack of riverine input and the resulting loss of nutrients and sediments and decreased productivity in vegetation communities (see Sections 3.2.2, 3.3.2, and 3.3.4). Hoeppner et al. (2007) concluded that the majority of the Maurepas Swamp is stressed and seems to be on a trajectory of slow degradation leading to a gradual conversion to marsh and open water. Stagnant flooding and nutrient deprivation appear to be the largest stressors in the swamp interior, while a combination of increased salinity, flooding stress, and nutrient deprivation is killing large proportions of the trees located along the lakeshore, particularly along the eastern margin of Lake Maurepas.

Natural regeneration throughout the Maurepas Swamp is very low and even absent at most sites. Land conversion observations on the Manchac land-bridge and Jones Island demonstrate what is expected in the Maurepas Swamp in the coming decades, if no restoration action is taken. In 1956, most of the area of the Manchac land-bridge was dominated by second-growth swamp. By 1978, much of this swamp had converted to marsh and shrub-scrub, and by 1990 the marsh had begun to break up and to convert to open water (Barras et al. 1994).

Consequently, it is expected that without restoration, the factors and processes that are contributing to stress and deterioration of the swamps in the vicinity of the Amite River Diversion Canal will continue and will result in loss of the swamp, with succession to open water. The remaining portion of the western Maurepas Swamp is composed of approximately 65 percent tupelo trees and 35 percent baldcypress trees, and as of 1990, covered an area within the Amite/Blind Rivers mapping unit of about 138,900 acres of swamp and 3,440 acres of fresh marsh (CWPPRA Task Force, 2002). The wetland loss rates for the Amite/Blind Rivers mapping unit for 1974-90 were estimated by USACE to be 0.83 percent per year for the swamps, and 0.02 percent per year for fresh marsh. Based on these rates, approximately 50 percent (or 69,450 acres) of swamp and 1.2 percent (or about 40 acres) of fresh marsh will be lost within 60 years

(CWPPRA Task Force 2002). The USACE determined that, based on the low tree density, degraded condition, and expectation for mortality, the majority of swamp habitat within the study area will degrade to less than 33 percent canopy cover within 20 years (USACE 2004b).

Under the continued influence of these conditions, tree mortality will continue to increase and tree density will continue to decline, until most swamp habitat in the vicinity of the Amite River Diversion Canal converts to fresh marsh. Monitoring studies conducted for the CWPPRA PPL 12 proposal indicated that conversion of baldcypress-tupelo swamp to fresh marsh is already occurring in the study area, particularly north of the diversion canal in the eastern study area (CWPPRA Task Force 2002). The results of these monitoring studies indicate that many areas of interior swamp in the study area and vicinity that exhibit significantly stressed or dying overstory vegetation also contain bulltongue or arrow arum as understory vegetation. Additionally, the monitoring results indicate that many areas of bulltongue marsh in the greater southern Maurepas Swamp have converted to fragile spikerush flotant. Factors contributing to this conversion include the much greater tolerance of baldcypress and water tupelo with respect to herbaceous understory vegetation for long-term deep inundation, and the increasingly unconsolidated nature of swamp substrate caused by the reduction of below-ground productivity. Consequently, it is expected that the vast majority of swamp habitat adjacent to the Amite River Diversion Canal would convert to open water rather than stable marsh habitat without implementation of the proposed project.

3.3.6 Increased Subsidence

Increased subsidence is a physical response to lack of riverine input and the resulting loss of nutrients and sediments and decreased productivity in vegetation communities (see Sections 3.2.2, 3.3.2, and 3.3.4). The soil characteristics within the western Maurepas Swamp are indicative of a lack of riverine influence as evidenced by high soil organic matter content and low bulk density values (DeLaune et al. 1979, Hatton 1981, Messina and Conner 1998). Soil building within the Maurepas Swamp occurs almost exclusively as a result of organic productivity; in the swamps adjacent to the diversion canal, this productivity is substantially depressed compared to normal conditions (CWPPRA Task Force 2002). Subsidence in this area is classified as intermediate, at about 1.1 to 2 feet per century (USACE 2004a). With minimal soil building and moderately high subsidence, there has been a net lowering of ground surface elevation, leading to a doubling in flood frequency over the last four decades (Thomson 2000), so that the swamps are now persistently flooded.

Shaffer et al. (2003) conducted a subsidence investigation in the Maurepas Swamp immediately southeast of this project's study area in support of CWPPRA project PO-29 *Mississippi River Reintroduction into Maurepas Swamp*. Subsidence rates for the PO-29 project area were measured by the installation of two surface elevation tables at 13 representative study sites. The tables could be set in four compass directions and utilized the mean value of nine pin readings of soil elevation. Readings were collected during the interval October-November 2001 and compared against readings collected in October-November 2002 to provide an accurate estimate of the net subsidence rates within the Maurepas Swamp. The results of this subsidence investigation indicate an average net elevation decrease of slightly less than one centimeter for the study area during the interval between sampling, although actual rates varied considerably by habitat type.

3.4 Attributes and Performance Measures

3.4.1 Land Cover

Land cover has been identified as a key indicator of project success with respect to preventing habitat conversion and future land loss. Comparison of pre-project land cover characteristics with post-project land cover characteristics would serve to determine if conversion of baldcypress-tupelo swamp to freshwater marsh or open water within the study area experiences a post-project decline or ceases altogether. Additionally, post-project land cover analysis would determine if areas within the study area that had previously converted to freshwater marsh or open water experience undergo a post-project reversion to baldcypress-tupelo swamp as a result of improved seedling survival.

- *Spatial analysis* has been identified as an assessment performance measure for the determination of the response of land cover to the proposed project. Spatial analysis may involve comparative analysis of pre-project and post-project aerial or satellite imagery and may utilize thematic mapper analysis to determine relative changes in baldcypress-tupelo swamp coverage within the study area.

A post-project relative increase in the total area of baldcypress-tupelo swamp would be an indication of significant project success, while a post-project stabilization of baldcypress-tupelo swamp coverage within the study area would be an indication of moderate project success. Conversely, a post-project decline in baldcypress-tupelo swamp coverage within the study area would indicate that the project did not succeed in preventing habitat conversion and, by extension, future habitat loss.

3.4.2 Vegetation Productivity

Swamp vegetation productivity has been identified as a key indicator of project success. Comparison of pre-project vegetation monitoring data with post-project vegetation monitoring data would serve to determine if biomass production in plant communities within the study area increases in response to project features. A post-project increase in biomass production would also indicate the introduction of nutrients and sediment into the swamps as a result of the project. Three assessment performance measures have been identified for this attribute, including percent cover, diameter at breast height (dbh) and litterfall.

- *Percent cover* is the estimated percentage of the ground surface covered by vegetation. Canopy percent cover is the estimated percentage of the ground surface covered by tree canopies when the crowns are projected vertically. A high percent cover is indicative of significant productivity within the respective vegetation communities, and a higher canopy percent cover is indicative of significant productivity within woody species.
- *Diameter at breast height (dbh)* is the measurement of tree diameter at a height of 4.5 feet above the forest floor on the uphill side of the tree. A large annual increase in dbh is indicative of significant productivity with respect to the measured tree and adjacent forest community. Ongoing monitoring studies of baldcypress and tupelo trees within the western Maurepas Swamp by Dr. Gary Shaffer indicate that average annual dbh increase for trees within the eastern study area is approximately one millimeter per year, a growth level that is significantly lower than expected levels of 1-2 centimeters per year for healthy baldcypress or tupelo trees (Shaffer, personal communication 2009).
- *Litterfall* is the measurement of the movement of leaves, twigs, and other forms of organic matter from the biosphere to the litter layer found in soil via interception in

collection traps. Large volumes of litterfall are indicative of significant biomass production within the constituent forest community.

A post-project relative increase in productivity within the study area as evidenced by these three measures would be an indication of significant project success, while a post-project stabilization of these measures would be an indication of moderate project success. Conversely, a post-project decline in these measures within the study area would indicate that the project did not succeed in increasing swamp vegetation productivity.

3.4.3 Elevation

Ground surface elevation has been identified as a key indicator of project success with respect to reducing or reversing subsidence within the study area. Comparison of pre-project elevation levels with post-project elevation levels would serve to determine if sediment input and soil accretion is occurring within the study area in response to project features. A post-project increase in elevation would implicitly indicate the introduction of nutrients and sediment into the swamps as a result of the project, and would also indicate an increase in vegetation productivity and the resulting litterfall that is a principal factor in soil accretion within the Maurepas Swamp. Two assessment performance measures have been identified for this attribute, including surface elevation table (SET) measurements and feldspar marker horizon measurements.

- *Surface Elevation Table (SET) measurements* provide a constant reference plane in space from which the distance to the sediment surface can be measured by means of pins lowered to the sediment surface. Repeated measurements of elevation can be made with high precision because the orientation of the table in space remains fixed for each sampling. Elevation change measured by the SET is influenced by both surface and subsurface processes occurring within the soil profile.
- *Feldspar marker horizon measurements* involve the placement of a cohesive layer of feldspar clay on the ground surface. Soil borings are extracted at the marker horizon location periodically to measure the amount of soil deposition and/or accretion that has occurred above the horizon since placement. Significant quantities of soil atop marker horizons are indicative of soil building within the area, which in turn indicates an increase in relative elevation.

Post-project increases in elevation as evidenced by SET measurements or documented soil accretion atop a marker horizon within the study area would be an indication of significant project success, while a post-project stabilization of elevation as evidenced by these measures would be an indication of moderate project success. Conversely, a post-project decline in elevation within the study area would indicate that the project did not succeed in offsetting subsidence and, by extension, habitat conversion and future land loss.

3.4.4 Water Quality

Surface water quality in interior locations in the study area has been identified as a key indicator of project success with respect to establishing hydrologic connectivity between the Amite River Diversion Canal and the adjacent swamp habitat. Comparison of pre-project water quality with post-project quality would serve to determine if freshwater throughput is introducing nutrients and flushing out saline waters within the study area in response to project features. A post-project improvement in water quality would implicitly indicate the introduction of freshwater

and the associated nutrients and sediment into the swamps as a result of the project. Four assessment performance measures have been identified for this attribute, including total suspended solids (TSS), dissolved oxygen (DO), nutrients, and salinity.

- *Total suspended solids* (TSS) is a measurement of the total volume of sediment and other solids suspended in a given volume of water. Because surface waters within the swamps adjacent to the Amite River Diversion Canal are hydrologically isolated from other waterbodies in the study area, TSS concentrations within swamp surface waters are expected to be lower than those of nearby waterbodies.
- *Dissolved oxygen* (DO) is a relative measure of the amount of oxygen that is dissolved in a given volume of water. Surface waters within the swamps in the study area are expected to exhibit lower DO concentrations than those of nearby waterbodies, because water movement (which exposes surface water to a greater volume of air through lateral movement and results in greater dissolution of oxygen) is virtually nonexistent in the swamps.
- *Nutrients* are chemical compounds or minerals contained in surface waters that are extracted by organisms for nourishment. Common nutrients in surface waters include nitrates, phosphates, and ammonia. Surface waters within the swamps adjacent to the Amite River Diversion Canal have been demonstrated to be nutrient-poor with respect to other waterbodies in the area because the hydrology prevents the accumulation of nutrients from surface runoff.
- *Salinity* is a measure of the concentration of dissolved salt in a given volume of water. Surface waters within the study area often exhibit elevated salinity levels with respect to other area waterbodies because saline storm surges introduced into the swamps during tropical cyclone events become trapped in the impounded swamps and are not allowed to drain out of the study area.

Post-project improvements in water quality within the study area as evidenced by analyses of these measures would be an indication of significant project success, while a post-project stabilization or decline in water quality within the study area would indicate that the project did not succeed in reestablishing riverine input to the study area and the resulting reintroduction of nutrients and sediments associated with freshwater throughput.

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Appendix J

Real Estate Plan (REP)

REAL ESTATE PLAN

Amite River Diversion Canal Modification Feasibility Study
Livingston, Ascension and St John the Baptist Parishes, Louisiana



May 6, 2010

Real Estate Plan
Amite River Diversion Canal Modification Feasibility Study
Livingston, Ascension and St. John the Baptist Parishes, Louisiana

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REAL ESTATE PLAN

Amite River Diversion Canal Modification Feasibility Study
Livingston, and Ascension Parishes, Louisiana



Purpose:

The purpose of this Real Estate Plan is to determine the impact of the proposed construction on the real estate located within the project limits. This Real Estate Plan (REP) presents a preliminary plan for any acquisitions of lands, easements, relocations and rights-of-way necessary for construction and implementation of the project. Contact with landowners in the study area has been limited. This document is for planning purposes only and is subject to change.

The project is intended to reverse the trend of degradation of the lands located in the Western Maurepas Swamp. The introduction of freshwater from the diversion canal onto and across this land will restore hydrologic connectivity and provide valuable nutrients to the surrounding swamp. The increase in sediments will facilitate land building and offset the effects of subsidence. The enhancement of the wet/dry cycles will promote germination and promote survival of seedlings to enhance establishment of new forest growth.

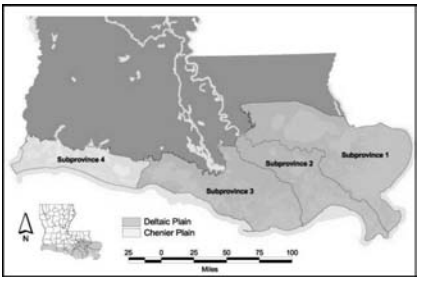
The goal of this project is to reverse the degradation trend within the western Maurepas Swamp ecosystem so as to contribute toward achieving and sustaining a coastal ecosystem tha can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

Project Location and Study Area:

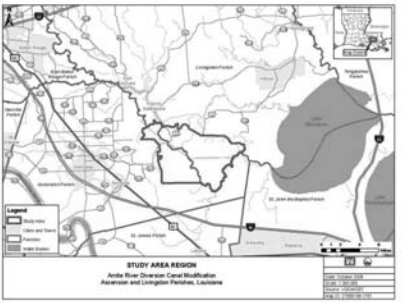
The Louisiana Coastal Authority (LCA) study area, which includes the Louisiana coastal area from Mississippi to Texas, is comprised of two wetland-dominated

ecosystems, the Deltaic Plain of the Mississippi River and the closely linked Chenier Plain, both of which are influenced by the Mississippi River. For planning purposes, the LCA study area was divided into four subprovinces, with the Deltaic Plain comprising Subprovinces 1, 2, and 3, and the Chenier Plain comprising Subprovince 4 as shown in Figure 1.1. The LCA-Amite River Diversion Channel (ARDC) study area as shown in Figures 1.2 and 1.3 is located in LCA Subprovince 1 and is situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana. The study area is bounded to the north by the old channel of the Amite River, Old River, Chinquapin Canal and Bayou Chene Blanc; to the east by the Blind River; to the south by the Petite Amite River and the New River Canal; and to the west by the Sevario Canal, Ascension Parish flood protection levees, and the Laurel Ridge Canal; and is located in the following sections:

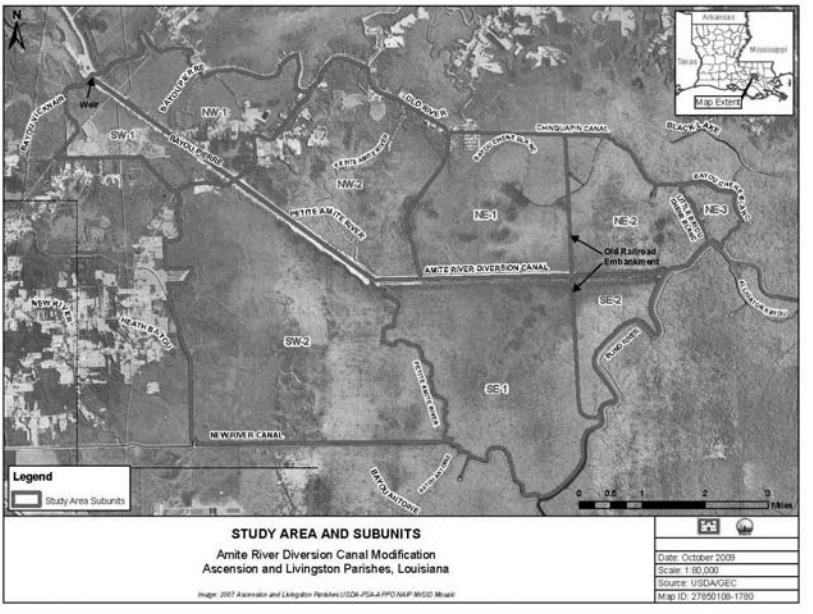
- Township 9 South, Range 4 East, Sections 9-16, 22-27, and 34-36;
- Township 9 South, Range 5 East, Sections 7, 14-36;
- Township 9 South, Range 6 East, Section 30 and 19;
- Township 10 South, Range 4 East, Sections 1-3 and 10-12; and
- Township 10 South, Range 5 East, Sections 2-11.



LCA Ecosystem Restoration Study, 2004
Figure 1.1



Study Area Region
Figure 1.2



Study Area and Subunits
Figure 1.3

For planning purposes the study area has been divided into nine separate hydrologic subunits. Each subunit was developed based on hydrologic differences that exist throughout the study area due to natural and manmade hydrologic boundaries as shown in Figure 1.4. These boundaries include natural topography such as dredged material berms and natural ridges, as well as manmade and natural waterways. The tentatively selected plan is located in hydrologic subunit NE-2. This subunit has a high degree of habitat degradation and has little to no hydrologic connectivity. The subunit is surrounded by the Chinquapin Canal to the north, an abandoned railroad embankment to the west, the ARDC to the south, and Little Bayou Chene Blanc and Blind River to the east.

Project Sponsor:

The non-Federal sponsor is the Coastal Protection and Restoration Authority of Louisiana (CPRA). However the Office of Coastal Protection and Restoration (OCPR) is the implementing arm of CPRA, which has been given authority to acquire and hold these lands. As the non-Federal Sponsor, CPRA through OCPR must provide all real estate interests required for this proposed project construction, i.e., all lands, easements, right of way relocations, and any other interests, including suitable borrow and dredged or excavated material disposal areas (LERRDs). OCPR has indicated it would provide all lands, water bodies, and/or water bottoms that are owned, claimed, or controlled by the State of Louisiana. If it becomes necessary OCPR, having no "quick take" authority of its own, will partner with another public agency, such as the Pontchartrain Levee District (PLD), to acquire the lands needed for this project. The NFS feels confident in being able to meet the "public need" requirements of the quick take statutes of the State of Louisiana.

General Project Description:

In or around 1956 the Amite River Diversion Project was constructed to enhance drainage and flood control by diverting water from the Amite River to Lake Maurepas. The ARDC is a 10.6 mile long artificial channel that extends from the Amite River at mile 25.3 to mile 4.8 of the Blind River in Ascension and Livingston parishes (see Figure 1.2). The canal is roughly 80 meters wide. As part of this construction, spoil was deposited on each side of the newly constructed channel for future use. Since the early 1960's, camp sites and homes have been constructed on these spoil banks. Over the years since its construction, the result of these developments and this flood control project has been the loss of fresh water and nutrient flowing into, out of and across the proposed project area. As shown in the photograph in Figure 1.5, the hydrological restrictions of the project in the 1950's had the unintended consequence of wetland destruction. Storm surge from hurricanes have accelerated the damage because of salt-water intrusion. The transition from the swamp to an open water marsh is occurring.

This Real Estate Plan has been prepared after study and review of seven (7) of the original thirty-nine (39) alternatives presented by the Project Development Team

(PDT). These alternatives underwent additional screening to determine the maximum benefit for the sponsorships investments.



Figure 1.5 Degraded Swamp Area

Impacts on existing uses of the land and restrictions to the land in the future as a result of the project have been discussed during our process. The Real Estate Plan considers the characteristics of the lands found within the project area as well as the impact of the Tentatively Selected Plan (TSP). It is anticipated the increased hydrologic connectivity will provide nutrients and sediments to the impact areas and enhance the restoration of the swamp and prevent further degradation of the area. The final TSP should closely restore the natural wet/dry cycles in this area before the construction of the spoil banks. The result should promote seedling germination and promote survival to enhance establishment of new forest growth.

Figure 1.6 depicts the North East quadrant of the Study Area. This map shows the location of the TSP, Alt 33. The scope of work outlined in Alt 33 is concentrated in sections 23, 24, 25, 26 & 27.

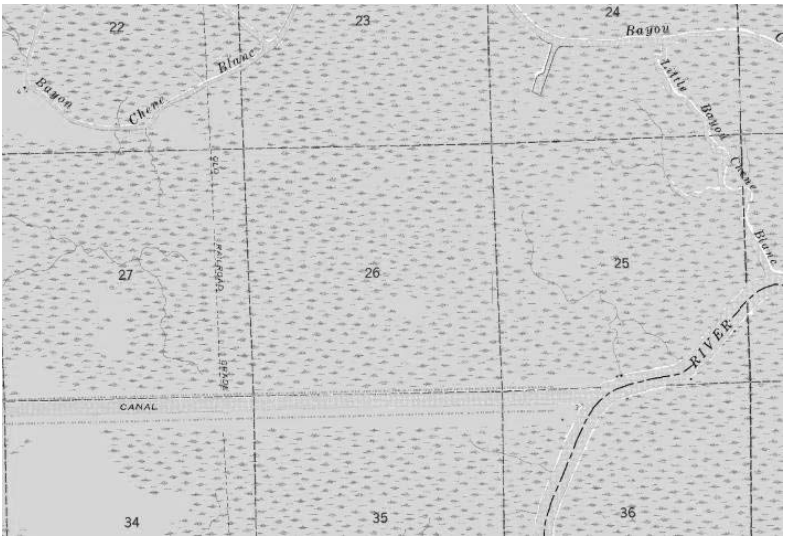


Figure 1.6 Quadrangle Map of the Project Area.

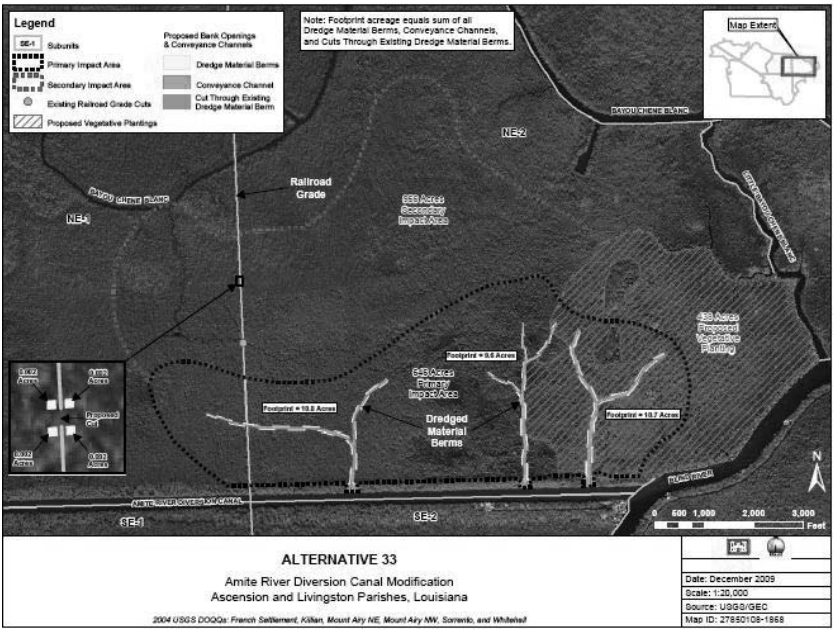


Figure 1.7 -TSP / Alternative 33

Features of the TSP (Figure 1.7) include:

- Three dredged material bank openings and three conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast in alternating berms so sheet flow is not reduced.
- One additional cut would be in the railroad grade approximately one-half mile north of the existing cut in NE-1/NE-2.
- Vegetative plantings of bottomland hardwood / freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Implementation of this alternative would restore the hydrologic connectivity between NE-1 and NE-2 with the ARDC thus reducing impoundment within the wetlands. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of bottomland hardwood habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (attached Exhibit I). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along alternating portions of the channels to allow sufficient sheet flow to be conveyed from the swamp.

Non-Federal Owned LER:

The Non-Federal sponsor does not own any lands in the project right of way.

Estates:

The anticipated number of private property owners impacted by this project is one (1), Blind River Properties, represented by Mr. Glen Martin. Blind River Properties owns approximately 32,000 acres; a significant portion of this land is located within the study area and the ownership encompasses all of the project area. See Figure 1.8. No servitudes and rights of ways for pipelines or utilities are located in the project area.

It is Corps of Engineers policy to acquire fee simple title for ecosystem restoration projects. Two reasons for such requirement is to reduce the risk that incompatible uses on project land will occur after project construction, and to ensure that ownership rights vested in the project are clear and enforceable (ER 1105-2-100, Appendix F, Amendment # 2, F-20b(2)(a). However, regulations also indicate that a lesser interest, such as, a specific type of permanent easement, may be appropriate depending upon the operational requirements of the project and other circumstances relevant to project implementation, including landowner preference (EP 1165-2-502, 17b). Circumstances wherein the acquisition of interests less than fee may be appropriate is where only select and easily identifiable and narrow affirmative rights are required for successful implementation of the project (ER 1105-2-100, Appendix F, Amendment # 2, F-20b(2)(b)i.)

It is the opinion of the Non-Federal Sponsor and the District that construction of this project can be accomplished through the acquisition of easements rather than fee. We propose acquisition of the following estates: a Channel or Channel Improvement Easement over 23.6 acres of canal banks along the ARDC and existing waterways; a

Wetland Creation and Restoration Easement over 438 acres to allow for vegetative plantings on existing degraded swamplands and wetlands; and a Flowage and Deposition Easement over 1,161± acres of swamplands which will be further inundated by the flow of water from the channel cuts. However, it should be noted that this is a planning document and the necessary estates are subject to change dependant upon project needs.

It is the opinion of the project delivery team that the estates proposed herein provide sufficient rights to the Government to construct the project and also protect the interests of the Government by prohibiting use of the surface for mineral exploration or construction of improvements. In addition, because the project area is a wetland, the project features are further protected through the police powers of the Federal Government through Section 404 of the Clean Water Act which require a permit from the Corps of Engineers for any activity that could negatively impact a wetland. Lastly, due to the topography of the project site and its limited access, it is highly unlikely that the landowner would propose development.

The non-standard estates were presented in the Louisiana Coastal Area – Louisiana, Ecosystem Restoration Study, dated November 2004. Exhibit IV includes a memorandum requesting approval of acquisition of interests less than fee as well as approval of these non standard estates in accordance with SOP established by MVD in December 2009.

THE NON-STANDARD ESTATES PRESENTED IN THIS REP ARE NOT APPROVED AS PART OF THIS REAL ESTATE PLAN AND FURTHER REVIEW, REVISION, AND APPROVAL OF SUCH ESTATES IS REQUIRED.

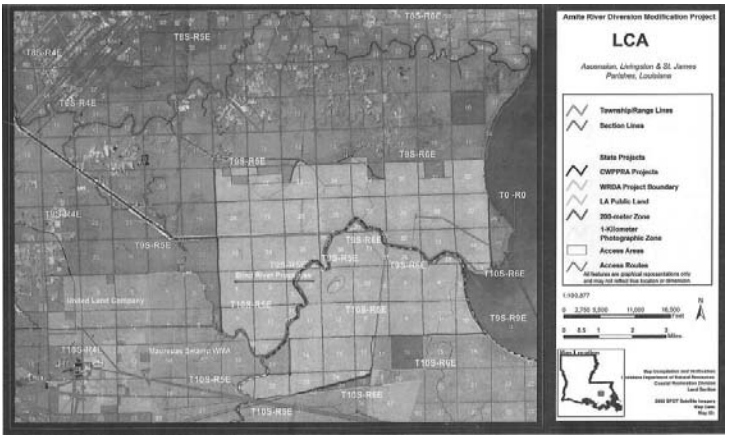


Figure 1.8 – Blind River Properties

Channel or Channel Improvement Easement (standard estate)

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____) for the purposes as authorized by the Act of Congress approved_____, including he right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate: dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements far public roads and highways, public utilities, railroads and pipelines.

Wetland Creation And Restoration Easement (non-standard estate): (based on the standard Perpetual Beach Nourishment Easement and other standard estates)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. -) to construct, operate, maintain, patrol, repair, renourish, and replace wetlands and associated coastal habitats, including the right to borrow and/or deposit fill; to accomplish any alterations of contours on said land; to plant vegetation on said land; to excavate, dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; to construct dikes and to install, alter, relocate, repair or plug cuts in the banks of dikes; to construct, operate and maintain pipelines for the purpose of dredge or spoil material transport and deposition; to move, store and remove equipment and supplies; to plug, fill or alter pipeline canals located within the limits of the easement; to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the easement (excepting the structures now existing on the land, described as _____), provided that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill, [that no vehicles shall be operated within the limits of the easement without such approval, except as may be required to operate and maintain the easement,] and that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs,) successors and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; and expressly excepting

and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

Flowage and Deposition Easement [*] (non-standard estate):

The perpetual right, power, privilege and easement occasionally to overflow the land described in Schedule A (Tracts Nos. ____, ____) and in connection with the operation and maintenance of the project, including the continuing right to clear and remove and brush, debris and natural obstructions which, in the opinion of the representative of the United States in charge of the project, may be detrimental to the project; and to deposit dredge material or sediment on the land, together with all right, title and interest in and to the structures and improvements now situate on the land, excepting _____ (here identify those structures not designed for human habitation which the District Engineer determines may remain on the land); provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no vehicles shall be operated within the limits of the easement without such approval, except as may be required to operate and maintain the easement, that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution; and expressly, excepting and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

[*] *Because nutrients will flow from the Amite River Diversion Canal into the benefits area via the channel cuts, a "Flowage and Deposition Easement" is suggested. However, no emergent lands will be created as a result of direct deposition of sediment.*

Sponsor Land Acquisition Experience:

The Non-Federal sponsor for this project is the Coastal Protection and Restoration Authority of Louisiana (CPRA), through the Office of Coastal Protection and Restoration. As the non-federal sponsor, CPRA must provide all real estate interests required for the project, i.e., all lands, easements, rights-of-way, relocations, and any other interest, including suitable borrow and dredged or excavated material disposal areas (LERRDs).

The Non-Federal Sponsor is assessed to be fully capable to perform all acquisition activities associated with this project. The Sponsor has the capability to acquire and hold real estate as well as the ability to contract for real estate services to supplement its staff in order to meet project schedules. However, it must be recognized herein that CPRA is the non-federal sponsor for all New Orleans District coastal restoration projects and all hurricane risk reduction projects. Therefore, if all LCA projects and several hurricane risk reduction projects are authorized for construction under concurrent schedules, there is a possibility that CPRA may not be able to accomplish LER acquisition due to the massive amount of work required for such an undertaking. If that were the case, it is possible that CPRA may request that the Federal Government accomplish acquisition of LER on their behalf.

The Assessment of the Non-Federal Sponsor's Real Estate Acquisition Capabilities is attached as Exhibit II.

Real Estate Acquisition Schedule:

Acquisition will not begin until after the Project Partnering Agreement (PPA) is signed. Based on current schedule information, the land rights acquisitions would need to be started February 1, 2012 to meet the construction date of August 1, 2012. Based on acquisition of right of way from one landowner, estimated task durations are:

Task	**Task Duration**
Obtain title information	60 days
Obtain mapping information	60 days
Obtain appraisals	60 days
Negotiate & issue right-of-entry	90 days

These time frames assume amicable acquisitions, if condemnation proceedings are necessary, 12 months will be added to the schedule.

Public Law 91- 646:

All acquisitions of private property for this project will be done in accordance with the provisions of Public Law 91-646, as amended. All areas impacted by construction are vacant; the project will not displace any persons, businesses or farms.

Acquisition Costs:

The estimated total Real Estate costs are $136,000.00. Real Estate costs have been outlined in the Chart of Accounts found in Exhibit III.

Landowner Attitude:

Owner contact, to date, has been limited. However, feedback from the private landowner, Mr. Glen Martin, has been positive. Mr. Glen Martin representing Blind River Properties owns the land required for this TSP. The landowner appears to be in favor of the project, given the direct benefits to his property.

Environmental Issues:

A Phase I Environmental Site Assessment (ESA) of the LCA-ARDC study area was conducted in accordance with USACE Regulation ER 1165-2-132, Water Resources Policies and Authorities for HTRW Guidance for Civil Works Projects, 26 June 1992 and the American Society for Testing and Materials (ASTM) Standard E 2247-08 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property in order to identify recognized environmental conditions (REC) located on, or in the vicinity of, the LCA-ARDC study area.

A review of various Federal and state databases indicates that none of the potential recognized environmental conditions (REC) sites found in the area would be likely to expose the public or construction workers to HTRW or to adversely affect the project.

Existing Federal Projects & State/Federal Owned Lands:

While we know the construction of the Amite River Diversion Canal was a public project, done in conjunction with the USACE and Livingston Parish, we have been unable to confirm easements or agreements to establish ownership or restrictions of the spoil banks. Additional research will be required when this project advances. At a recent meeting with the landowner, he stated the Diversion Project was built as part of the drainage servitude and the spoil, and the water bottoms, belong to Blind River Properties. This will be verified when the project progresses and prior to any agreements being executed.

Timber / Mineral / Row Crop Activity:

A timber survey and appraisal was conducted in 1994 by a professional forestry consultants for the 32,000 acres owned by Blind River

Properties. The consultants found that there were no areas of cypress and tupelo in the swamps with trees of sufficient size and volume to be considered merchantable. Merchantable size timber (red oak, sweet gum, and ash) was found only on the ridges, including those in the study area. However, marketability was considered doubtful because of inaccessibility. There is no timber harvesting in the project area.

The western Maurepas Swamp has undergone significant oil and gas exploration activity, particularly in the early to mid-20th century. However, most oil and gas exploration and production activities in the region have occurred southwest of the study area. Data from the LDNR Strategic Online Natural Resources Information System (SONRIS) (http://sonris-www.dnr.state.la.us/www_root/sonris_portal_1.htm) indicate that oil and gas production activities within the study area have been relatively light and occurred primarily in the late 20th century. It is our understanding that the owner of the minerals is the same entity which owns the surface rights. The easements to be acquired by the Government prohibit constructing improvements without the written permission of the United States which in essence could prohibit use of the surface for the exploration of minerals over the encumbered areas. The ownership impacted by this project is approximately 32,000 acres; the project areas are surrounded by the remaining unencumbered lands. The owner has access points throughout the perimeter of the project area to conduct directional drilling for oil or gas in the event that those minerals are present in the property. Therefore, the acquisition of the proposed easements does not impose a mineral taking.

There is no evidence of row crop activity in the project area.

Induced Flooding:

The construction of this project will allow water from the Amite River Diversion Canal to flow into, onto and across private land discharging into the adjacent swamp. As the water dissipates, sediments and nutrients will be deposited to assist in swamp restoration. Where water will flow across private lands, OCPR will acquire Flowage Easements.

Zoning Ordinances:

No zoning ordinances will be enacted in lieu of or to facilitate acquisition in connection with this project.

Utilities and Facilities to be Relocated:

There are no utility or facility relocations required in connection with this project.

Navigation Servitude:

Derived from the Commerce Clause of the U.S. Constitution, article 1, section 8, clause 3, the navigation servitude is the dominant right of the United States to use, control and regulate navigable waters and submerged lands. The applicability of the

navigation servitude depends on both legal and factual determinations. If the legal determination supports assertion of the navigation servitude, then the second step is to determine the geographical area over which the servitude can be asserted. In tidal areas, the servitude extends to all lands below the mean high water mark, whereas in non-tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high water mark.

There are no lands being acquired for this project which would fall in this classification.

Acquisition Prior to PPA:

The non-federal sponsor is the author of this REP and is fully aware of the risks associated with acquisition of real estate rights prior to signing a Project Partnership Agreement.

This report has been prepared by the undersigned in accordance with Chapter 12 of the ER405-1-12.

Prepared By:

Ronnie Rabalais
SJB Group, LLC
Division Manager Real Estate Services
April 21, 2010

Reviewed By:

Erin A. Clark
USACE Appraiser
April 21, 2010

Judith Y. Gutierrez
USACE, Chief, Appr & Plang
April 21, 2010

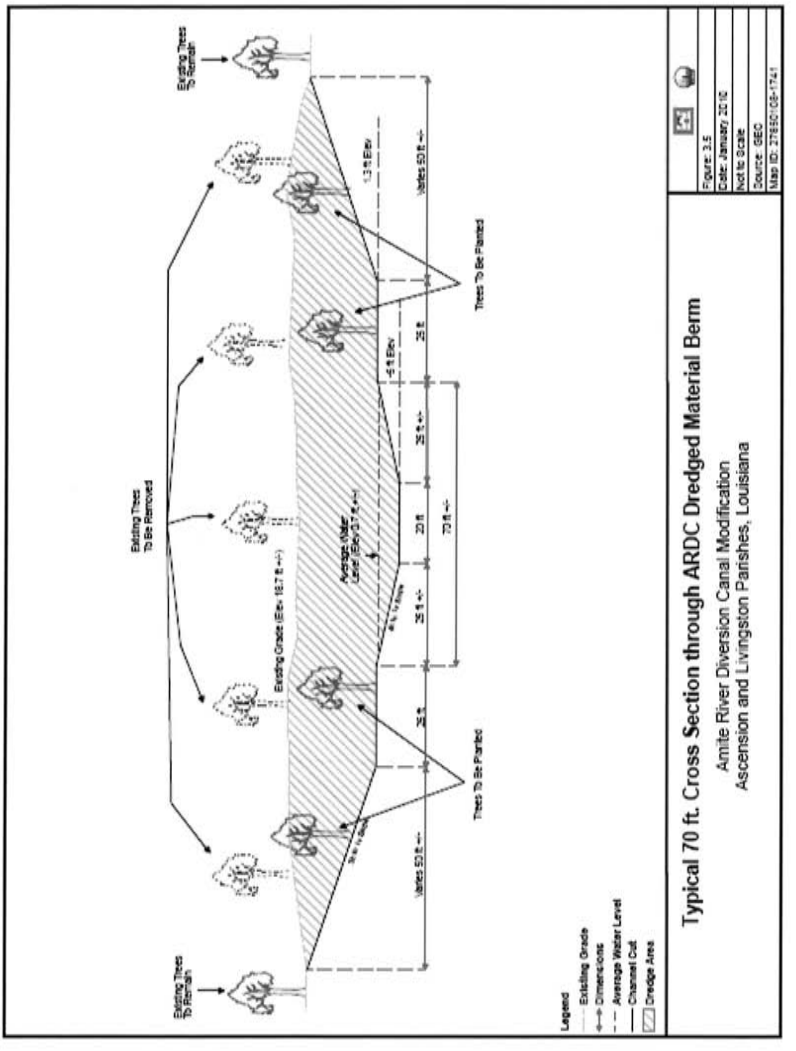
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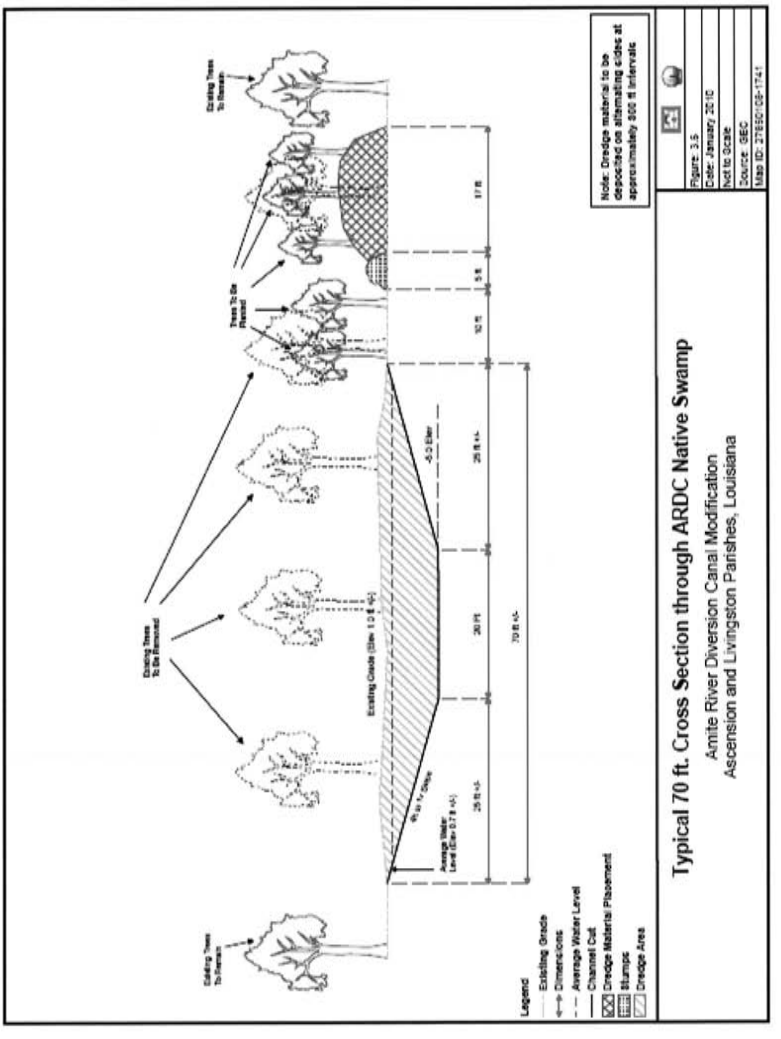
Linda C. LaBure
USACE, Chief Real Estate Div
April 21, 2010

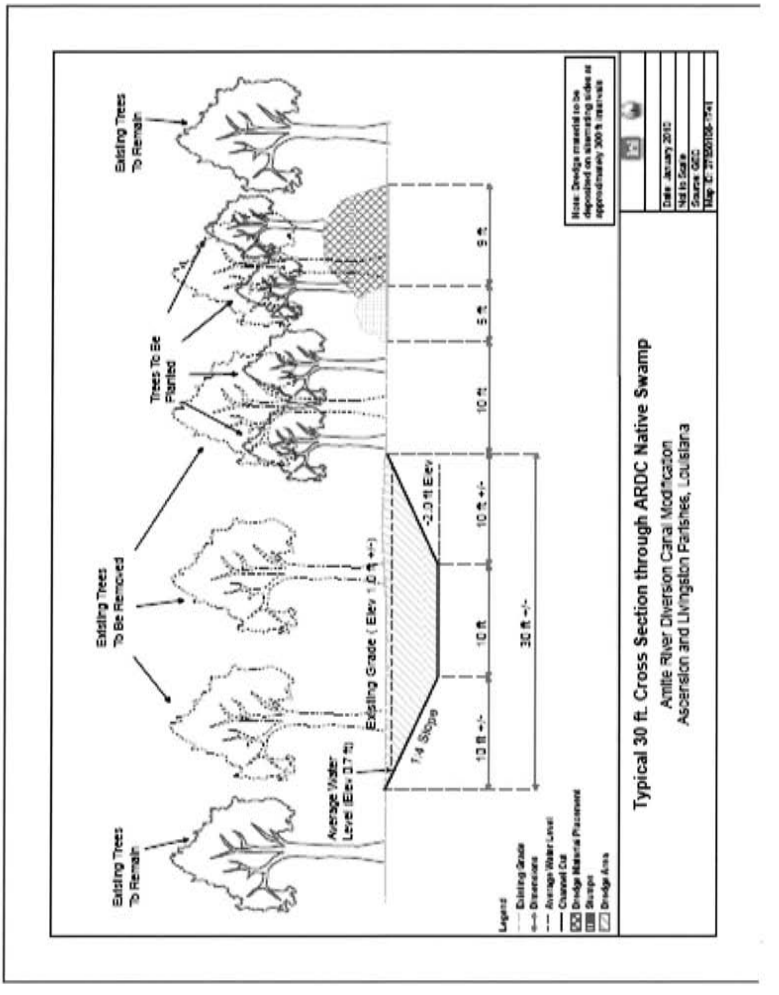
Exhibit I

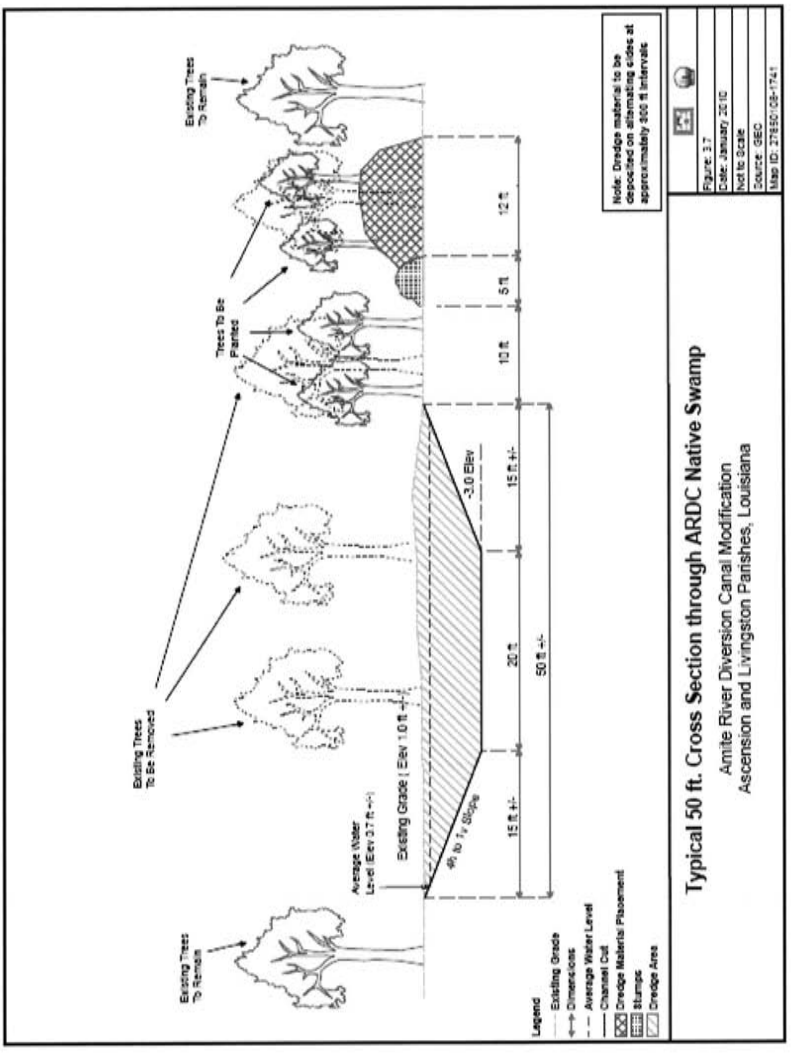
Cross Sections for Channel Easements for Alternative 33

It should be noted that uniform channel widths and not the tapered channels shown within this Exhibit, were used when area calculations were provided for benefit calculations. These areas, given the nature and scope of the construction, are minor.


Existing Trees To Remain
Existing Trees To Remain
Existing Trees To Be Removed
Existing Grade (Elev. 18.7 ft +/-)
Average Water Level (Elev. 0.7 ft +/-)
1.3 ft Elev
-4 ft Elev
Trees To Be Planted
Trees To Be Planted
Varies 50 ft +/-
Varies 50 ft +/-
25 ft
25 ft +/-
20 ft
25 ft +/-
25 ft
70 ft +/-
Legend
Existing Grade
Dimensions
Average Water Level
Channel Cut
Dredge Area
Typical 70 ft. Cross Section through ARDC Dredged Material Berm
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Figure: 3.5
Date: January 2010
Not to Scale
Source: GEC
Map ID: 21565-06-1741


Typical 70 ft. Cross Section through ARDC Native Swamp
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Legend
Existing Grade
Dimensions
Average Water Level
Channel Cut
Dredge Material Placement
Stumps
Dredge Area
Existing Trees To Remain
Existing Trees To Be Removed
Trees To Be Removed
Existing Trees To Remain
Existing Grade (Elev. 1.0 ft +/-)
Average Water Level (Elev. 0.7 ft +/-)
4:1 Slope
4:1 Slope
25 ft +/-
20 ft
25 ft +/-
70 ft +/-
10 ft
5 ft
17 ft
Note: Dredge material to be deposited on alternating sides at approximately 800 ft intervals
Figure 3.5
Date: January 2016
Not to Scale
Source: GEC
Map ID: 276501108-1741


Existing Trees To Remain
Existing Trees To Be Removed
Trees To Be Planted
Existing Trees To Remain
Average Water Level (Elev -0.7 ft)
Existing Grade (Elev 1.0 ft +/-)
1:4 Slope
+2.0 ft Elev
10 ft
10 ft +/-
10 ft
5 ft
5 ft
10 ft +/-
30 ft +/-
Legend
Existing Grade
Dimension
Average Water Level
Channel Cut
Dredge Material Placement
Swamp
Dredge Area
Note: Dredge material to be deposited on alternating sides of approximately 3000 ft reaches
Typical 30 ft. Cross Section through ARDC Native Swamp
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Date: January 2010
Not to Scale
Source: GDC


Typical 50 ft. Cross Section through ARDC Native Swamp
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Figure 3.7
Date: January 2010
Not to Scale
Source: GIEC
Map ID: 27450-06-1741
Legend
Existing Grade
Dimensions
Average Water Level
Channel Cut
Dredge Material Placement
Stumps
Dredge Area
Existing Trees To Remain
Existing Trees To Be Removed
Trees To Be Planted
Existing Trees To Remain
Average Water Level Elev 0.7 ft +/-
Existing Grade Elev 1.0 ft +/-
4ft to 1v Slope
-3.0 Elev
15 ft +/-
20 ft
15 ft +/-
50 ft +/-
10 ft
5 ft
10 ft
Note: Dredge material to be deposited on alternating sides at approximately 300 ft intervals

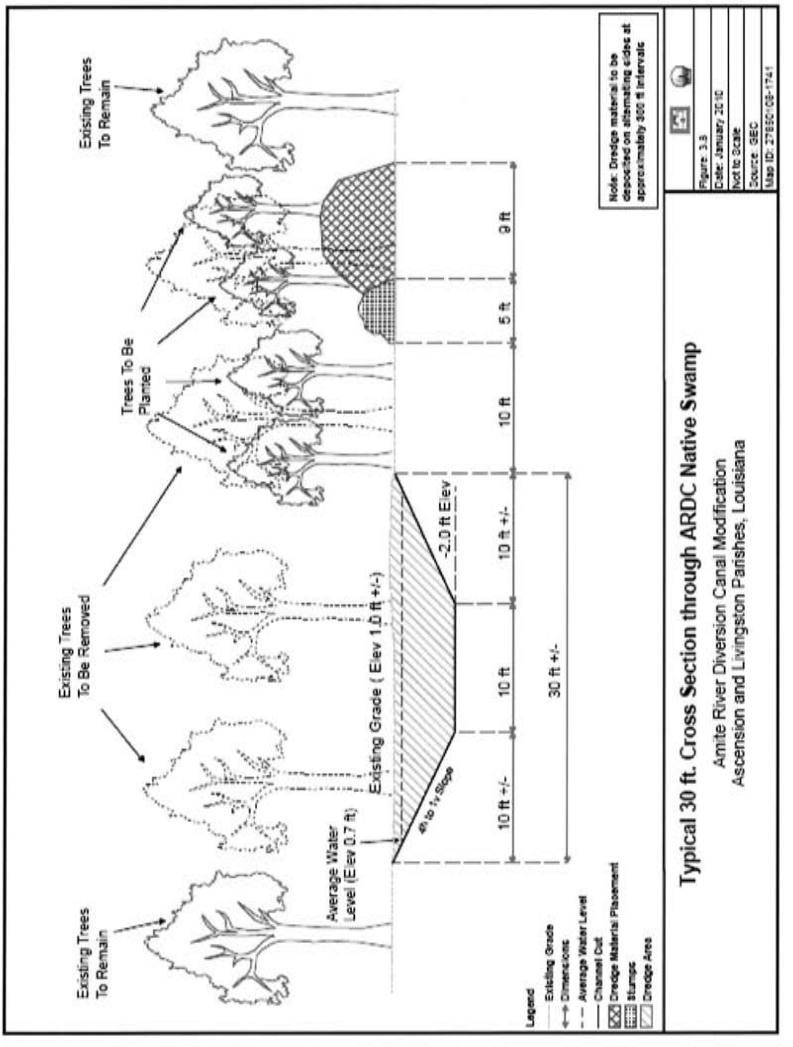

Existing Trees To Remain
Existing Trees To Be Removed
Trees To Be Planted
Existing Trees To Remain
Average Water Level (Elev 0.7 ft)
Existing Grade (Elev 1.0 ft +/-)
4h to 1v Slope
-2.0 ft Elev
10 ft +/-
10 ft
30 ft +/-
10 ft +/-
10 ft
5 ft
9 ft
Legend
Existing Grade
Dimensions
Average Water Level
Channel Cut
Dredge Material Placement
Stumps
Dredge Area
Note: Dredge material to be deposited on alternating sides at approximately 300 ft intervals
Typical 30 ft. Cross Section through ARDC Native Swamp
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Figure: 3.3
Date: January 2016
Not to Scale
Source: GEC
Map ID: 27650-08-1741

Exhibit II

ASSESSMENT OF NON-FEDERAL SPONSOR REAL ESTATE ACQUISITION CAPABILITY

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY
Coastal Protection Restoration Authority (CPRA)
through the
Office of Coastal Protection and Restoration (OCPR)

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power of eminent domain for this project? **YES - But limited to expropriation.**

c. Does the sponsor have "quick-take" authority for this project? **NO - Although the sponsor does not have quick take authority, if this should be needed for the project, the sponsor may partner with a Levee District or Parish Government who has this authority (Act 225 RS38:301.1 and Act 320) if they agree.**

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **Unknown**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? **N/A**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule?
The office of OCPR is staffed with 3 Land Specialists and one Manager. Given current and projected workload, the in-house staff is not sufficient to accomplish acquisition of realty interests for this project.

e. Can the sponsor obtain contractor support, if required in a timely fashion? **Unknown, no schedule has been drafted. Contracting typically takes 12 to 18 months.**

f. Will the sponsor likely request USACE assistance in acquiring real estate?
Yes it is likely, but ultimately depends on the responsibilities as agreed upon in the PPA yet to be developed.

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project/real estate schedule/milestones?

"A detailed schedule will be developed when the final ROW is determined. Normally, an estimate of one year is allowed to acquire ROW for a project." Once project designs are finalized, the sponsor will be requested to provide an acquisition schedule.

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? **YES**

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable.
Fully capable

V. Coordination:

a. Has this assessment been coordinated with the sponsor?
YES

b. Does the sponsor concur with this assessment?
YES

Prepared By:

Judith Y. Gutierrez
USACE
Chief, Appraisal. & Planning Branch

James L. Altman
OCPR
Land Manager

Approved By:

Linda C. LaBure
Chief, Real Estate Division

Exhibit III

CHART OF ACCOUNTS

					AMOUNT ROUNDED	CONTINGENCY	PROJECT COST **$136,000**
	TOTAL PROJECT COSTS				112,900	23,360	136,260
01	**LANDS AND DAMAGES**		CONTINGENCY	PROJECT COST	112,900	23,360	136,260
01B	**ACQUISITIONS**						
01B10	BY GOVERNMENT	0	0	0			
01B20	BY NON FEDERAL SPONSOR (NFS)	9,500	0	9,500			
01B30	BY GOVT ON BEHALF OF NFS	0	0	0			
01B40	REVIEW OF NFS	5,000	0	5,000			
01C	**CONDEMNATIONS**						
01C10	BY GOVERNMENT	0	0	0			
01C20	BY NFS	0	0	0			
01C30	BY GOVT ON BEHALF OF NFS	0	0	0			
01C40	REVIEW OF NFS	0	0	0			
01E	**APPRAISAL**						
01E10	BY GOVT (IN HOUSE)	0	0	0			
01E20	BY GOVT (CONTRACT)	0	0	0			
01E30	BY NFS	3,000	0	3,000			
01E40	BY GOVT ON BEHALF OF NFS	0	0	0			
01E50	REVIEW OF NFS	2,000	0	2,000			
01F	**PL 91-646 ASSISTANCE**						
01F10	BY GOVERNMENT	0	0	0			
01F20	BY NFS	0	0	0			
01F30	BY GOVT ON BEHALF OF NFS	0	0	0			
01F40	REVIEW OF NFS	0	0	0			
01G	**TEMPORARY PERMITS/LICENSES/RIGHTS-OF-ENTRY**						
01G10	BY GOVERNMENT	0	0	0			
01G20	BY NFS	0	0	0			
01G30	BY GOVT ON BEHALF OF NFS	0	0	0			
01G40	REVIEW OF NFS	0	0	0			
01G50	OTHER	0	0	0			
01G60	DAMAGE CLAIMS	0	0	0			
01N00	**FACILITY/UTILITY RELOCATIONS**						
01R	**REAL ESTATE PAYMENTS**						
01R1	**LAND PAYMENTS**						
01R1A	BY GOVERNMENT	0	0	0			
01R1B	BY NFS	92,900	23,230	116,130			
01R1C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R1D	REVIEW OF NFS	0	0	0			
01R2	**PL 91-646 ASSISTANCE PAYMENTS**						
01R2A	BY GOVERNMENT	0	0	0			
01R2B	BY NFS	0	0	0			
01R2C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R2D	REVIEW OF NFS	0	0	0			
01R3	**DAMAGE PAYMENTS**						
01R3A	BY GOVERNMENT	0	0	0			
01R3B	BY NFS	0	0	0			
01R3C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R3D	REVIEW OF NFS	0	0	0			
01R9	**OTHER**	0	0	0			
01T	**LERRD CREDITING**						
01T20	ADMINISTRATIVE COSTS	500	130	630			

Exhibit IV

Non-Standard Estate Approval Request

LCA: AMITE RIVER DIVERSION CANAL MODIFICATION
REQUEST FOR APPROVAL TO DEVIATE FROM FEE TAKING AND
REQUEST FOR APPROVAL OF NON-STANDARD ESTATES

1. This is a request for approval to deviate from acquisition of the Fee estate for the LCA Amite River Diversion Canal Modification project and request for approval to acquire a Channel and Channel Improvement Easement (standard estate), a Wetland Creation and Restoration Easement (non-standard estate), and a Flowage and Deposition Easement (non-standard estate) to accomplish the project.

2. The detailed project purpose and description is contained within the Real Estate Plan. The project entails making three cuts along the banks of the Amite River Diversion Channel (ARDC) and dredging three coordinating channels to flow water from the ARDC to the Maurepas Swamp. The dredged material from these conveyance channels will be sidecast to form bottomland hardwood habitat. In addition, bottomland hardwood/freshwater swamp tree species will be planted throughout the swamp. The project would closely restore the natural wet/dry cycles that existed in this area before the construction of the ARDC and adjacent spoil banks. The result should promote seedling germination and promote survival of habitats to enhance establishment of new forest growth.

3. A map depicting the location of all project features is included in the Real Estate Plan as Figure 1.7 –TSP/ Alternative 33 on page 9.

4. The District acknowledges that it is Corps of Engineers policy to acquire fee simple title for ecosystem restoration projects in order to reduce the risk that incompatible uses on project land will occur after project construction, and to ensure that ownership rights vested in the project are clear and enforceable (ER 1105-2-100, Appendix F, Amendment # 2, F-20b(2)(a). However, regulations also indicate that a lesser interest, such as, a specific type of permanent easement, may be appropriate depending upon the operational requirements of the project and other circumstances relevant to project implementation, including landowner preference (EP 1165-2-502, 17b). Circumstances wherein the acquisition of interests less than fee may be appropriate is where only select and easily identifiable and narrow affirmative rights are required for successful implementation of the project (ER 1105-2-100, Appendix F, Amendment # 2, F-20b(2)(b)i.)

5. It is the opinion of the Non-Federal Sponsor and the District that construction of this project can be accomplished through the acquisition of perpetual easements rather than fee. The project has specific features in defined areas, and the necessary real estate rights are narrow, affirmative rights that can easily be defined. The standard Channel and Channel Improvement Easement would allow the Government sufficient rights to construct the cuts along the ARDC and the conveyance channels. District Office of Council has prepared a non-standard Wetland Creation and Restoration Easement that would allow the Government necessary rights to place soil and plant vegetation in the swamp to improve the habitat and would protect the environment by prohibiting construction of structures, excavation of the property or placement of fill without approval by the United States. The estate also prohibits use of the surface to explore for minerals. District Office of Council has also prepared a non-standard Flowage and Deposition Easement which in addition to allowing flooding of lands

allows disposal of spoil material and prohibits use of the surface for mineral exploration, thus protecting the habitat.

6. It is the opinion of the project delivery team that the estates proposed herein provide sufficient rights to the Government to construct the project and also protect the interests of the Government by prohibiting use of the surface for mineral exploration or construction of improvements. In addition, because the project area is a wetland, the project features are further protected through the police powers of the Federal Government through Section 404 of the Clean Water Act which require a permit from the Corps of Engineers for any activity that could negatively impact a wetland. Lastly, due to the topography of the project site and its limited access, it is highly unlikely that the landowner would propose development.

7. The cost of managing fee owned lands is similar to the cost of managing lands encumbered by easements except for the initial year. Fee lands are surveyed and monumented. Given that the property impacted by this project is remote and it is wetlands, the cost of the survey is approximately $5,000. For subsequent years, the cost of managing the easement would be approximately $2,100, and the cost of managing fee would be approximately $2,800.

8. The team proposes the acquisition of easements rather than fee considering that this project is one of 15 Louisiana Coastal Area (LCA) projects which collectively encompass thousands of acres. The decisions regarding which estates to acquire for Amite River Diversion Channel Modification will impact the other 14 LCA projects. The non-federal sponsor, The Coastal Protection Restoration Authority, is not in favor of owning fee interest over the project area for Amite River Diversion Channel Modification. The mission of the non-federal sponsor is to oversee all hurricane risk reduction projects and all coastal restoration projects in south Louisiana. The sponsor is willing to acquire a fee estate when it is absolutely necessary for the project. However, owning fee lands for public access is not within the authorized missions of the non-federal sponsor.

9. Approval of the non-standard Wetland Creation and Restoration Easement is requested because there is no standard easement that includes the real estate rights necessary for construction of certain project features. The project includes disposal of dredged material in designated areas to use it beneficially to enhance existing marsh and to propagate the growth of marsh in waterbottoms as well as vegetative plantings of bottomland hardwood / freshwater swamp tree species.

    - The Wetland Creation and Restoration Easement provides all the necessary rights to protect the marsh and trees that are planted as well as the marsh that will naturally propagate in the project areas. The only potential use of the property, given its location and physical characteristics, is for recreation (fishing and hunting) and mineral development. Recreational uses will not impact the viability of the project. The Wetland Creation and Restoration Easement prohibits the construction of structures, operation of vehicles, excavation of the land, placement of landfill, cutting of trees, and the use of the surface for mineral exploration without prior approval by the United States.

    - The cost of acquiring the Wetland Creation and Restoration Easement is less than the cost of acquiring Fee.

- The Wetland Creation and Restoration Easement was written using language from several standard estates such as the Perpetual Beach Nourishment Easement, the Perpetual Beach Storm Damage Reduction Easement , the Fee Excluding Minerals (with restrictions on use of the surface), and the Flowage Easement (Permanent Flooding).

- For ease of review, attached as Exhibit A is a highlighted version of the Wetland Creation and Restoration Easement indicating which language was taken from standard estates and which language is non-standard. Also attached as exhibit B is a final version of the estate. Exhibit C is a written statement from Office of Counsel (MVN), indicating the legal sufficiency of the Non-Standard Estate.

10. Approval is also requested for a non-standard Flowage and Deposition Easement. Because the standard Flowage Easement does not account for the deposition of sediment, a non-standard estate is needed to encompass this project feature.

    - This non-standard estate has been constructed in the same format as the standard Flowage Easement. Language has been added to give the Government the right to deposit dredge material or sediment on the land. Language has also been added to protect the existing ecosystem by giving the Government the right to prohibit the operation of vehicles without prior permission and the right to prohibit trimming, cutting, felling and the removal of trees or vegetation without prior permission. The non-standard estate allows for the Grantor to retain mineral rights, but restricts the use of surface for the purpose of drilling and extracting oil, gas and other minerals.

    - The cost associated with acquiring the non-standard Flowage and Deposition Easement is similar to the cost of acquiring a standard Flowage Easement. The reason for this is that both estates include the right to flood the land. This right is what has the most detrimental impact on the property's remainder value. The properties over which the non-standard estate will be acquired are wetlands where the harvesting of timber is unlikely. Therefore, the deposition of sediment and the prohibition of vehicle operations and removal of trees do not have a significant impact on the value of the property or the value of the easement.

    - For ease of review, attached as Exhibit D is a highlighted version of the Flowage and Deposition Easement which indicates which language was taken from standard estates and which language is non-standard. Also attached as exhibit E is a final version of the estate. Exhibit F is a written statement from Office of Counsel (MVN), indicating the legal sufficiency of the Non-Standard Estate.

11. Similar non-standard Wetland Creation and Restoration Easement and Flowage and Deposition Easement were previously approved for the 2004 LCA Project Report.

12. Also enclosed as Exhibit G is a Quality Control Checklist, Request to Deviate from Guidance as to Appropriate Interest to Acquire and/or Request for Approval of Use of Non-Standard Estate.

13. Point of contact for this request is Ms. Judith Gutierrez, 504-862-2575.

Prepared by:

Judith Y. Gutierrez
Chief, Appraisal & Planning Branch
USACE, MVN, Real Estate Division

Approved by:

Linda C. LaBure
Chief, Real Estate Division
USACE, MVN

WETLAND CREATION AND RESTORATION EASEMENT
(based on the standard Perpetual Beach Nourishment Easement and other standard estates)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. -) to construct, operate, maintain, patrol, repair, renourish, and replace wetlands and associated coastal habitats, including the right to borrow and/or deposit fill; to accomplish any alterations of contours on said land; to plant vegetation on said land; to excavate, dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; to construct dikes and to install, alter, relocate, repair or plug cuts in the banks of dikes; to construct, operate and maintain pipelines for the purpose of dredge or spoil material transport and deposition; to move, store and remove equipment and supplies; to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the easement (excepting the structures now existing on the land, described as _____); provided that no structures for permanent human habitation shall be constructed or maintained on the land; that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill, and that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs,) successors and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; and expressly excepting and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

Comment [JYG1]: Standard Perpetual Beach Nourishment Easement

Comment [JYG2]: Non-Standard language

Comment [MB3]: From standard perpetual beach storm damage reduction easement.

Comment [MB4]: From standard channel improvement easement.

Comment [MB5]: Non-Standard language from LCA 2004 wetland creation and restoration easement.

Comment [MB6]: From standard perpetual beach storm damage reduction easement.

Comment [JYG7]: Standard Perpetual Beach Nourishment Easement

Comment [MB8]: Adapted from the standard flowage easement (permanent flooding) and standard flowage easement (occasional flooding).

Comment [MB9]: Non-Standard language added to safeguard against destruction of project benefits.

Comment [MB10]: From the standard fee excluding minerals estate, differs from LCA 2004 easement in that it prohibits surface activities altogether. I clarified the term "other minerals" so that it could not be interpreted to include solid minerals.

(Note only the language with red font is non-standard language. All other language is taken from standard estates).

Exhibit A

WETLAND CREATION AND RESTORATION EASEMENT
(based on the standard Perpetual Beach
Nourishment Easement and other standard estates)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. -) to construct, operate, maintain, patrol, repair, renourish, and replace wetlands and associated coastal habitats, including the right to borrow and/or deposit fill; to accomplish any alterations of contours on said land; to plant vegetation on said land; to excavate, dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; to construct dikes and to install, alter, relocate, repair or plug cuts in the banks of dikes; to construct, operate and maintain pipelines for the purpose of dredge or spoil material transport and deposition; to move, store and remove equipment and supplies; to plug, fill or alter pipeline canals located within the limits of the easement; to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the easement (excepting the structures now existing on the land, described as _____), provided that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill, [that no vehicles shall be operated within the limits of the easement without such approval, except as may be required to operate and maintain the easement,] and that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs,) successors and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; and expressly excepting and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

Exhibit B

STATEMENT OF REVIEW AND APPROVAL
LCA AMITE RIVER DIVERSION CANAL MODIFICATION
WETLAND CREATION AND RESTORATION EASEMENT
NON-STANDARD ESTATE

This is to certify that the Wetland Creation and Restoration Easement, a non-standard estate, has been reviewed and is legally sufficient for the requirements of the above referenced project.

Mayely Boyce
Attorney Advisor

7/29/10
Date

Exhibit C

FLOWAGE AND DEPOSITION EASEMENT
(based on the standard Flowage Easement and standard Fee Excluding Minerals)

The perpetual right, power, privilege and easement occasionally to overflow the land described in Schedule A (Tracts Nos. ____, ____) and in connection with the operation and maintenance of the project, including the continuing right to clear and remove and brush, debris and natural obstructions which, in the opinion of the representative of the United States in charge of the project, may be detrimental to the project; and to deposit dredge material or sediment on the land, together with all right, title and interest in and to the structures and improvements now situate on the land, excepting _____ (here identify those structures not designed for human habitation which the District Engineer determines may remain on the land); provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no vehicles shall be operated within the limits of the easement without such approval, except as may be required to operate and maintain the easement, that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution; and expressly, excepting and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

Comment [JYG11]: Standard Flowage Easement (Occasional Flooding)

Comment [JYG12]: Standard Flowage Easement (Permanent Flooding)

Comment [JYG13]: Non-Standard language

Comment [JYG14]: Standard Flowage Easement (Permanent Flooding)

Comment [JYG15]: Non-Standard language

Comment [JYG16]: Standard Flowage Easement (Permanent Flooding)

Comment [JYG17]: Deleted the word coal which is not present in Louisiana and clarified the meaning of other minerals used in the 2004 LCA report to prevent interpretation as solid minerals.

Comment [JYG18]: Standard Fee Excluding Minerals

(Note only the language with red font is non-standard language. All other language is taken from standard estates).

Exhibit D

FLOWAGE AND DEPOSITION EASEMENT
(based on the standard Flowage Easement, standard Fee Excluding Minerals, and the non-standard Dredged Material Disposal Easement)

The perpetual right, power, privilege and easement occasionally to overflow the land described in Schedule A (Tracts Nos. ____, ____) and in connection with the operation and maintenance of the project, including the continuing right to clear and remove and brush, debris and natural obstructions which, in the opinion of the representative of the United States in charge of the project, may be detrimental to the project; and to deposit dredge material or sediment on the land, together with all right, title and interest in and to the structures and improvements now situate on the land, excepting _____ (here identify those structures not designed for human habitation which the District Engineer determines may remain on the land); provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, that no vehicles shall be operated within the limits of the easement without such approval, except as may be required to operate and maintain the easement, that no trimming, cutting, felling or removal of trees, underbrush, and any other vegetation shall be conducted without such approval, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution; and expressly, excepting and excluding all oil, gas and other minerals occurring naturally in liquid or gaseous form, in and under said land and all appurtenant rights for the exploration, development, production and removal of said oil, gas and other minerals occurring naturally in liquid or gaseous form, but without the right to enter upon or over the surface of said land for the purpose of exploration, development, production and removal therefrom of said oil, gas and other minerals occurring naturally in liquid or gaseous form.

Exhibit E

STATEMENT OF REVIEW AND APPROVAL
LCA AMITE RIVER DIVERSION CANAL MODIFICATION
FLOWAGE AND DEPOSITION EASEMENT
NON-STANDARD ESTATE

This is to certify that the Flowage and Deposition Easement, a non-standard estate, has been reviewed and is legally sufficient for the requirements of the above referenced project.

Mayely Boyce
Attorney Advisor

7/29/10
Date

Exhibit F

Quality Control Checklist

Request to Deviated from Guidance as to Appropriate Interest to Acquire
and/or
Request for Approval of Use of Non-standard Estate

ER 405-1-12, paragraphs 12-9 and 12-10

PROJECT: LCA AMITE RIVER DIVERSION CANAL MODIFICATION

Title and date of Decision Document which contains the REP requesting approval of estate deviation or NSE approval LCA Amite River Diversion Canal Modification Feasibility Study

Subject line and date of memorandum requesting approval of estate deviation or NSE approval N/A – Requested as an exhibit in the Real Estate Plan

1. Does the proposed estate, whether standard or non-standard; provide sufficient interest for the construction, operation, and maintenance of the project? YES

2. Coordination has been made with the following and they concur with use of the proposed estate:

Project Management X
Operations X
E&C X
Office of Counsel X

Coordination was made with the following other functional groups. Environmental

3. A statement of legal sufficiency from OC is attached to the REP or memo requesting approval by HQ Yes

4. Is the cost to acquire the proposed estate more than cost of acquiring a standard interest with a standard estate? No Is this discussed in the request? YES

5. Did the Non-Federal Sponsor (NFS) propose the deviation from appropriate interest or use of a NSE? No
If so, why? _____
If not, was the deviation or NSE coordinated with the NFS? Yes

6. Can the non-standard estate be approved by the district Chief of RE? No

If so it must :
Serve the intended project purpose _____
Substantially conform with and not materially deviate form the corresponding standard estate _____
Does not increase the costs nor potential liability of the Government? _____

7. Does the NSE conform to format of standard estates _____Yes_____?

8. Does the request for approval which goes through MVD to HQ, contain a detailed explanation of and justification for the deviation as to interest to be acquired? _Yes_

9. Does the request contain a detailed explanation of each non-standard clause in the estate? _Yes__ The request must detail the need for the language in relation to project requirements. Each non-standard right to be acquired, restriction/prohibition placed on fee owner's interest and /or reservation to the fee owner must be fully discussed. Is the acquisition or reservation of mineral rights held by the fee owner or outstanding 3rd party mineral rights fully discussed in relation to the estate language and project requirements? ____Yes_____
If there are clauses found in the corresponding standard estate which have been deleted, is there an explanation of the deletion? ____N/A____

10. Has the district deviated as to the appropriate interest on similar projects in the past? ___Yes___ If so, which project(s)? __The Wetland Creation and Restoration Easement is proposed for approval for other LCA projects.

11. Has the proposed NSE been previously approved by HQ for use for a project in your district? ____No____. If so, which project(s)? ____
Provide a copy of the previous approval.

A copy of this Checklist is attached to the REP or memorandum requesting a deviation as to interest to be acquired or approval of a NSE. ___Yes___

___N/A_____ Date: _____
Realty Specialist or Appraiser

Judith Y. Antúnez

July 28, 2010
_____ Date: _____
Branch or Section Chief

Exhibit V

Quality Control Checklist

Quality Control Checklist
Real Estate Plans
And other similar Feasibility-Level Real Estate Planning Documents

ER 405-1-12, Section 12-16, Real Estate Handbook, 1 May 1998

A Real Estate Plan (REP) is prepared in support of a decision document for full-Federal or cost shared specifically authorized or continuing authority projects. It identifies and describes lands, easements and rights-of-way (LER) required for the construction, operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of a proposed project including requirements for mitigation, relocations, borrow material, and dredged or excavated material disposal. It also identifies and describes facility/utility relocations, LER value, and the acquisition process. The REP does not just cover LER to be acquired by the non-Federal sponsor (NFS) or Government. The report covers all LER needed for the project, including LER already owned by the NFS, Federal Government, other public entities, or subject to the navigation servitude.

The REP must contain a detailed discussion of the following 20 topics, as set out in Section 12-16 of the ER, including sufficient description of the rationale supporting each conclusion presented. If a topic is not applicable to the project, this should be stated in the REP. The pages of a REP should be numbered.

PROJECT **Amite River Diversion Canal Modification Project**

REPORT TITLE **Real Estate Plan**

Date of Report **March 12, 2010**

Date of REP **December 25, 2009**

1. **Purpose of the REP.** __√___
   a. Describe the purpose of the REP in relation to the project document that it supports.
   b. Describe the project for the Real Estate reviewer.
   c. Describe any previous REPs for the project.

2. **Describe LER.** __√____
   a. Account for all lands, easements, and rights-of-way underlying and required for the construction, OMRR&R of the project, including mitigation, relocations, borrow material and dredged or excavated material disposal, whether or not it will need to be acquired or will be credited to the NFS.
   b. Provide description of total LER required for each project purpose and feature.

c. Include LER already owned by the Government, the NFS and within the navigation servitude.
d. Show acreage, estates, number of tracts and ownerships, and estimated value.
e. Break down total acreage into fee and the various types and durations of easements.
f. Break down acreage by Government, NFS, other public entity, and private ownership, and lands within the navigation servitude.

3. **NFS-Owned LER**.__√____
   a. Describe NFS-owned acreage and interest and whether or not it is sufficient and available for project requirements.
   b. Discuss any crediting issues and describe NFS views on such issues.

4. Include any proposed **Non-Standard Estates**. __√___
   a. Use Standard Estates where possible.
   b. Non-standard estates must be approved by HQ to assure they meet DOJ standards for use in condemnations.
   c. Provide justification for use of the proposed non-standard estates.
   d. Request approval of the non-standard estates as part of document approval.
   e. If the document is to be approved at MSC level, the District must seek approval of the non-standard estate by separate request to HQ. This should be stated in the REP.
   f. Exception to HQ approval is District Chiefs of RE approval of non-standard estate if it serves intended project purposed, substantially conforms with and does not materially deviate from the standard estates found in the RE Handbook, and does not increase cost or potential liability to the Government. A copy of this approval should be included in the REP. (See Section 12-10c. of RE 405-1-12)
   g. Although estates are discussed generally in topic 2, it is a good idea to also state in this section which standard estates are to be acquired and attach a copy as an appendix. The duration of any temporary estates should be stated.

5. **Existing Federal Projects**. __√___
   a. Discuss whether there is any existing Federal project that lies fully of partially within LER required for the project.
   b. Describe the existing project, all previously-provided interests that are to be included in the current project, and identify the sponsor.
   c. Interest in land provided as an item of local cooperation for a previous Federal project is not eligible for credit.
   d. Additional interest in the same land is eligible for credit.

6. **Federally-Owned Lands** _√____
   a. Discuss whether there is any Federally owned land included within the LER required for the project.
   b. Describe the acreage and interest owned by the Government.
   c. Provide description of the views of the local agency representatives toward use of the land for the project and issues raised by the requirement for this land.

7. **Navigation Servitude.** __√___
   a. Identify LER required for the project that lies below the Ordinary High Water Mark, or Mean High Water Mark, as the case may be, of a navigable watercourse.
   b. Discuss whether navigation servitude is available
   c. Will it be exercised for project purposes? Discuss why or why not.
   d. Lands over which the navigation servitude is exercised are not to be acquired nor eligible for credit for a Federal navigation or flood control project or other project to which a navigation nexus can be shown.
   e. See paragraph 12-7 of ER 405-1-12.

8. **Map** _√____
   a. An aid to understanding
   b. Clearly depicting project area and tracts required, including existing LER, LER to be acquired, and lands within the navigation servitude.
   c. Depicts significant utilities and facilities to be relocated, any known or potential HTRW lands.

9. **Induced Flooding** can create a requirement for real estate acquisition. ___√___
   a. Discuss whether there will be flooding induced by the construction and OMRR&R of the project.
   b. If reasonably anticipated, describe nature, extent and whether additional acquisition of LER must or should occur.
   c. Physical Takings Analysis (separate from the REP) must be done if significant induced flooding anticipated considering depth, frequency, duration, and extent of induced flooding.
   d. Summarize findings of Takings Analysis in REP. Does it rise to the level of a taking for which just compensation is owed?

10. **Baseline Cost Estimate** as described in paragraph 12-18. __√___
    a. Provides information for the project cost estimates.
    b. Gross Appraisal includes the fair market value of all lands required for project construction and OMRR&R.
    c. PL 91-646 costs
    d. Incidental acquisition costs
    e. Incremental real estate costs discussed/supported.
    f. Is Gross Appraisal current? Does Gross Appraisal need to be updated due to changes in project LER requirements or time since report was prepared?

11. **Relocation Assistance Benefits** Anticipated. __√___
    a. Number of persons, farms, and businesses to be displaced and estimated cost of moving and reestablishment.
    b. Availability of replacement housing for owners/tenants
    c. Need for Last Resort Housing benefits
    d. Real Estate closing costs
    e. See current 49 CFR Part 24

12. **Mineral Activity**. __√___
    a. Description of present or anticipated mineral activity in vicinity that may affect construction, OMRR&R of project.
    b. Recommendation, including rationale, regarding acquisition of mineral rights or interest, including oil or gas.
    c. Discuss other surface or subsurface interests/timber harvesting activity
    d. Discuss effect of outstanding 3rd party mineral interests.
    e. Does estate properly address mineral rights in relation to the project?

13. **NFS Assessment** _√____
    a. Assessment of legal and professional capability and experience to acquire and provide LER for construction, OMRR&R of the Project.
    b. Condemnation authority
    c. Quick-take capability
    d. NFS advised of URA requirements
    e. NFS advised of requirements for documenting expenses for credit.
    f. If proposed that Government will acquire project LER on behalf of NFS, fully explain the reasons for the Government performing work.
    g. A copy of the signed and dated Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability (Appendix 12-E) is attached to the REP.

14. **Zoning** in Lieu of Acquisition __√___
    a. Discuss type and intended purpose
    b. Determine whether the proposed zoning proposal would amount to a taking for which compensation will be due.

15. **Schedule** __√___
    a. Reasonable and detailed Schedule of land acquisition milestones, including LER certification.
    b. Dates mutually agreed upon by Real Estate, PM, and NFS. _____

16. **Facility or Utility Relocations** __√___
    a. Describe the relocations, identity of owners, purpose of facilities/utilities, whether owners have compensable real property interest.
    b. A synopsis of the findings of the Preliminary Attorney's Investigation and Report of Compensable Interest is included in the REP as well as statements required by Sections 12-17c.(5) and (6).

c. Erroneous determinations can affect the accuracy of the project cost estimate and can confuse Congressional authorization.
d. Eligibility for substitute facility
   1. Project impact
   2. Compensable interest
   3. Public utility or facility
   4. Duty to replace
   5. Fair market value too difficult to determine or its application would result in an injustice to the landowner or the public.
e. See Sections 12-8, 12-17, and 12-22 of ER 405-1-12.

17. **HTRW** and Other Environmental Considerations __√____
    a. Discussion the impacts on the Real Estate acquisition process and LER value estimate due to known or suspected presence of contaminants.
    b. Status of District's investigation of contaminants.
    c. Are contaminants regulated under CERCLA, other statues, or State law?
    d. Is clean-up or other response required of non-CERCLA regulated material?
    e. If cost share, who is responsible for performing and paying cost of work?
    f. Status of NEPA and NHPA compliances
    g. See ER 1165-2-132, Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects.

18. **Landowner Attitude**. _√____
    a. Is there support, apathy, or opposition toward the project?
    b. Discuss any landowner concerns on issues such as condemnation, willing seller provisions, estates, acreages, etc.?

19. A statement that the **NFS has been notified in writing about the risks of acquiring LER before the execution of the PPA**. If not applicable, so state. _√____

20. **Other Relevant Real Estate Issues**. Anything material to the understanding of the RE aspects of the project. ___√____

A copy of the completed Checklist is attached to the REP. _√___

I have prepared and thoroughly reviewed the REP and all information, as required by Section 12-16 of ER 405-1-12, is contained in the Plan.

Preparer — Date: 4/13/2010

A copy of the Real Estate Internal Technical Review Guide for Civil Works Decision
Documents is attached and signed by me as the Reviewer

RE Internal Technical Reviewer — Date: 4/21/10

The REP has been signed and dated by the Preparer and the District Chief of Real Estate. ___√_____

Appendix K

ECONOMICS AND BENEFITS

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SECTION 1

Wetland Value Assessment Project Information Sheet
December 2009

Project Name: Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project

Project Type(s): Swamp restoration, hydrologic restoration, and vegetative planting

Sponsoring Agency: U.S. Army Corps of Engineers (USACE) and Louisiana Department of Natural Resources

Preparer of Wetland Value Assessment (WVA) information sheet: Karen Soileau
Information found in this project information sheet was obtained primarily from the Draft Feasibility Report appendix (CPE 2005 and 2007).

Project Area: The project area is situated along the Amite River Diversion Canal (ARDC) in Ascension and Livingston Parishes, in the vicinity of Head of Island, Louisiana. The project area is focused around the impaired bald cypress-tupelo swamp stands adjacent to the ARDC, extending northward and southward of the canal in the western portion of the Maurepas Swamp, located within the Pontchartrain Basin.

Project area boundaries were developed and delineated based on hydrologic features of the area suspected of being influenced by the LCA ARDC Modification project. For planning purposes, the project area was further divided into nine sub-areas. Those sub-areas are defined by topographic high points (e.g., dredged material berms, relict railroad grade, road embankments) or natural and artificial channels (e.g., rivers, canals) that would serve to impede or intercept hydrologic flows.

Problem: The project area includes the ARDC, a 10.6-mile-long flood control channel between the Amite and Blind Rivers. Dredged material excavated during channel construction was deposited in dredged material berms on either side of the canal. The construction of the ARDC and its associated dredged material berms, and the resulting impoundment, channelization, surge-related saltwater intrusion, and the loss of freshwater, sediments, and nutrients from the Amite River have all caused significant adverse impacts to the area, resulting in poor swamp health and ecosystem degradation in the western Maurepas Swamp.

Goal: The goal of the LCA ARDC Modification project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, so as to contribute toward achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation.

Objectives:

- Increase hydrologic connectivity between the degraded swamp and bottomland hardwood habitats within the study area and the ARDC by increasing the exchange of freshwater, sediments, and nutrients over the 50-year period of analysis.
- Reduce habitat conversion of swamp to open water within the study area over the 50-year period of analysis.
- Facilitate natural hydrologic cycle within the study area over the 50-year period of analysis by reducing impoundment in degraded swamp and bottomland hardwood habitats adjacent to the ARDC to improve tree productivity and seedling germination.
- Improve fish and wildlife habitat within the study area over the 50-year period of analysis.

Project Features:

1. Freshwater Reintroduction – Restoring processes that input freshwater, nutrients, and sediments are essential for establishing sustainable coastal swamp systems. The implementation of freshwater reintroduction measures that establish hydrologic connectivity between study area waterbodies and the adjacent swamp habitat could nourish existing swamp habitat to increase productivity and restore areas that have converted to freshwater marsh or open water, reintroduce sediments and nutrients throughout the ecosystem, and allow aquatic organisms access to previously unavailable habitats. The benefits that such reintroductions produce increase over time and continue as long as the reintroduction is operated and maintained. Additionally, freshwater reintroductions can be adaptively managed to respond to environmental changes and optimize benefits.

2. Habitat Restoration – The majority of the Maurepas Swamp is stressed as a result of hydrologic alteration and seems to be on a trajectory of slow degradation leading to a gradual conversion to marsh and open water (Hoeppner *et al.*, 2007). Without restoration, the factors and processes that are contributing to stress and deterioration of the swamps in the vicinity of the ARDC would continue and would result in loss of the swamp, with succession to open water. The wetland loss rates for the Coast 2050 Amite/Blind Rivers mapping unit (which contains the study area) for 1974-90 were estimated by the Corps to be 0.83 percent per year for swamp habitat, and 0.02 percent per year for fresh marsh. Based on these rates, approximately 50 percent of swamp and 1.2 percent of fresh marsh would be lost within 60 years (Coastal Wetlands Planning, Protection, and Restoration Act [CWPPRA] Task Force, 2002). Additionally, the Corps determined that, based on the low tree density, degraded condition, and expectation for mortality, the majority of swamp habitat within the study area would degrade to less than 33 percent canopy cover within 20 years (USACE, 2004). Under the continued influence of these conditions, tree mortality would continue to increase and tree density would continue to decline, until most swamp habitat in the vicinity of the ARDC converts to fresh marsh. Monitoring studies conducted for the CWPPRA Priority Project List 12 (PPL 12) proposal indicated that conversion of bald cypress-tupelo swamp to fresh marsh is already occurring in the study area,

particularly north of the ARDC in subunit NE-2 (CWPPRA Task Force, 2002). Additionally, the monitoring results indicate that many areas of fresh marsh in the greater southern Maurepas Swamp have converted to fragile spikerush flotant, which is particularly susceptible to nutrient starvation and fragmentation. Consequently, it is expected that the vast majority of swamp habitat adjacent to the ARDC would convert to open water rather than stable marsh habitat without implementation of the proposed project.

LOW SEA LEVEL RISE SCENARIO ASSUMPTIONS

Primary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (U.S. Department of Agriculture [USDA] 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should continue to improve habitat conditions within the area. Accordingly, we anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His diameter at breast height (dbh) estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our Wetland Value Assessment (WVA) data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated utilizing data collected by Southeast Louisiana University and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future

without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees in the canopy was increased over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within this portion of the project area are permanently flooded and have no flow/exchange.

Future Without Project

Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario and we anticipate the project area to remain permanently flooded with no flow/exchange.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Because the subject area is impounded with no flow/exchange we expect the

salinity to increase over time. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980)

and would, therefore, be considered a component of the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future <u>Without</u> Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50

year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the high benefit areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the primary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project

area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to

continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a

Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling

germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions

are higher in the 20 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 parts per thousand [ppt] from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a

Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling

germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future Without Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .15 inches per year tupelo et al = .10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from time year 0 to 25 and decrease significantly between time year 25 and 50 due to the projected loss of canopy cover.

Future With Project

Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA and information provided by Mr. Bernard Wood. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the primary impact areas would receive the most benefits from freshwater flows, nutrients, and sediments; thus, those areas should see the greatest increase in growth. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 167% of current growth in the high benefit areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under

the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the primary impact area would receive the highest amount of direct benefits from construction of the gaps and should experience a substantial increase in substrate accretion and nutrient input. In addition, being in the immediate area of the proposed gaps we assume that this area would receive a high level of flow-exchange. We, therefore, anticipate a seasonal flood duration with high flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season to increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is expected to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction for the first 10 years (i.e., 0.9 ppt from TY 1-10). Because of the anticipated increase in sea level rise over time, however, we assume an increase in mean high salinities of 1.0 and 1.2 ppt for TY 25 and 50, respectively.

Secondary Impact Areas

- ***Fresh Marsh*** – The Swamp Model was chosen for this area over the Fresh Marsh Model, even though there is less than a 33 percent canopy cover, because the area provides functions and values more closely associated with a swamp than a fresh marsh.

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. It was the consensus of the group that there is less than 33 percent overstory closure. [Class 1]

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, the area is expected to remain a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 1.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. However, cypress trees planted at TY1 would be 11 years old. In Louisiana, the height of cypress at 10 years of age is, on average, 17 feet (USDA 1980). Therefore, because there were no tree species within the midstory at TY 0 and because planted cypress trees would not be old enough yet to be considered a component of the overstory, we anticipate the stand structure would remain a Class 1.

Future With Project
Target Year 25 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Accordingly, we anticipate an overstory closure of 50 -75 percent with a midstory or herbaceous cover greater than 33 percent. [Class 4]

Future With Project
Target Year 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative

planting should continue to improve habitat conditions within the area. Accordingly, we anticipate an overstory closure of greater than or equal to 75 percent with either a midstory cover or herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 6.3 inches determined during our WVA data collection field assessment. Although our estimate is on the lower end of the range determined by Mr. Wood, because the subject area represents some of the more degraded habitat we feel that this estimate is representative of existing habitat conditions. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual

mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions and lack of tree species at TY 0 in the understory. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and is assumed to result in similar conditions as the 155 acre fresh marsh high benefit area since vegetated plantings are proposed.

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within this portion of the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the ARDC project is further from the lake (i.e., further from the source of saltwater intrusion)

the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***10 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 35 percent with an approximate midstory cover of 17 percent. [Class 2]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 2.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of the low tree density and degraded condition, we downgraded the variable to a Class 1.

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 2.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. While the majority cypress trees in the project area (planted at TY1) would be 11 years old, and would not be old enough yet to be considered a component of the overstory, other midstory tree species present at TY 0 (i.e., red maple, green ash, and water tupelo) would become a component of the overstory at TY 10. In addition, because

construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure between 33 and 50 percent and greater than a 33 percent midstory or herbaceous cover. [Class 3]

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area. In addition, planted cypress trees are expected to be over 31 feet at age 26 (USDA 1980) and would, therefore, be considered a component of the overstory. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between 6.5 and 8.25 inches, as compared to our average of 7.2 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality. In addition, we assume that minimal regeneration would occur over 50 years based on the degraded habitat conditions. Subsequently, under the future without project scenario, basal areas decreased from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive the benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient

enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore,

anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that

mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***20 - 30 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be approximately 60 percent with an approximate midstory cover of approximately 35 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Continued degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to less than 50 percent by TY10 (Class 2) and less than 33 percent by TY25 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was gathered during a July 30, 2009, field assessment. Those estimates, based on existing habitat conditions, were consistent with those found by Bernard Wood (Research Assistant Southeastern Louisiana University) through direct measurement of project area trees. His dbh estimate, for all tree species combined, was between

6.5 and 8.25 inches, as compared to our average of 7.9 inches determined during our WVA data collection field assessment. Basal area was estimated based on information gathered during the aforementioned field visit and data collected by Southeast Louisiana University over the past 10 years.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .11 inches per year tupelo et al = .08 inches per year). Basal area was again estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960) and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 20 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario, basal areas decrease from time year 0 to 50.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would

receive benefits from freshwater flows, nutrients, and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future <u>With</u>* and *Future <u>Without</u> Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are semi-permanently flooded and have low flow/exchange.

Future <u>Without</u> Project
Target Years 1 – 50 –

Continued degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain semi-permanently flooded over 50 years.

Future <u>With</u> Project
Target Years 1 – 50 –

We assume that the portions of the proposed project within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a semi-permanent flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

- ***30 -50 Years to Marsh***

Variable 1: Stand Structure

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood (Research Assistant Southeastern Louisiana University). Specifically, total canopy cover is estimated to be between 50 and 75 percent with a midstory cover greater than 33 percent or a herbaceous cover greater than 33 percent. [Class 4]

Future Without Project
Target Year 1 –

Because of the minimal time lapse since TY0, we predicted that the stand structure would remain a Class 4.

Future Without Project
Target Years 10 – 50 –

Degradation of the area is anticipated under the future without project scenario. Because of this, we assumed that overstory closure would be reduced to

less than 50 percent by TY25 (Class 3) and less than 33 percent by TY50 (Class 1).

Future With Project
Target Year 1 –

Because of the minimal time lapse since project construction (i.e., 1 year), we predicted that the stand structure would remain a Class 4.

Future With Project
Target Year 10 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions over time within the area. In addition, because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. We do not, however, anticipate a significant change in stand structure in this area over 10 years. Therefore, we predicted stand structure would remain a Class 4.

Future With Project
Target Years 25 – 50 –

The combined effects of increased deposition of fine-grained sediment, increased nutrient loading, increased freshwater flows, reduced salinities, seasonally-lower water levels, and vegetative planting should improve habitat conditions within the area over time. Because construction of the gaps is designed to allow for drainage of the area during ARDC low flow events, seedling germination, establishment, and survival is expected to increase. Thus, we anticipate an overstory canopy closure equal to or greater than 75 percent with a herbaceous cover or midstory cover greater than 33 percent. [Class 6]

Variable 2: Stand Maturity

Both *Future With* and *Future Without Project*
Target Year 0 –

This information was provided by Bernard Wood through direct measurement of project area trees.

Future Without Project
Target Years 1 – 50 –

Values based on information provided by Bernard Wood. Mean dbh for each species was estimated as the mean existing dbh plus the existing mean annual growth rate times X number of years (growth rate: cypress = .15 inches per year tupelo et al = .10 inches per year). Basal area was estimated based on data collected by Southeast Louisiana University over the past 10 years and percent composition of canopy trees was estimated based on best professional judgment. Within the PPL 12 WVA it was assumed that 50 percent of the tupelo et al would die over 20 years, but that actual mortality of cypress would be minimal. Over the 50 year project life, we assume that 75 percent of the tupelo et al would die with minimal cypress mortality occurring within the 10 year to marsh habitat type. Because habitat quality and conditions are higher in the 30 - 50 year to marsh habitat type, as compared to the 10 year to marsh habitat type, we assume that tupelo mortality would occur, but at a slower rate. Therefore, we predict that 50 percent of the tupelo et al would die over the 50 year project life. Subsequently, under the future without project scenario basal areas decrease slightly from time year 0 to 25 and decrease significantly between time year 25 and 50 due to the projected loss of canopy cover.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Under the future with project scenario, construction of the gaps is expected to stimulate productivity and growth of cypress and tupelo. We assume that the secondary impact areas would receive benefits from freshwater flows, nutrients,

and sediments; however, to a lesser extent than the primary impact areas. These assumptions are similar to those by Hamilton and Shaffer (2001) for the Maurepas Diversion Project. Results of studies by John Day in wetlands receiving secondary treated sewage suggest that introduction of nutrients as well as sediments from river water could stimulate production by 3-5 fold (Hamilton and Shaffer 2001). Comparison of productivity in swamps that are either managed, have more favorable hydrology, and/or are receiving nutrient enrichment suggest that the existing level of productivity in Maurepas are ½ to ¼ of average values. As a conservative projection, we assume growth rates to be 129% of current growth in the secondary impact areas, which is the same assumption used in the PPL 12 WVA. Percent composition of cypress trees was adjusted over the 50 years to mimic conditions in healthier portions of the project area. Basal area was estimated by a bottomland hardwood growth/basal area calculator developed by the United States Forest Service (Putnam et al. 1960).

Variable 3: Water Regime

Both *Future With* and *Future Without Project*
Target Year 0 –

At present the Maurepas Swamp within the project area are temporarily flooded and have low flow/exchange.

Future Without Project
Target Years 1 – 50 –

Degradation of the area is expected under the future without project scenario. Because the area has some level of flow/exchange (albeit low), we anticipate the area to remain temporarily flooded over 50 years.

Future With Project
Target Years 1 – 50 –

We assume that the portions of the proposed project

within the secondary impact areas are expected to see direct benefits from construction of the gaps, and should experience an increase in substrate accretion and nutrient input, however, to a lesser extent than the primary impact areas. Being located further from the proposed gaps than the primary impact areas, we assume that the secondary impact areas would also experience some level of improvement in flooding duration due to improved drainage of the swamp, however, not to the extent of the primary impact areas. We, therefore, anticipate a temporary flood duration with moderate flow/exchange.

Variable 4: Mean High Salinity During the Growing Season

Both *Future With* and *Future Without Project*
Target Year 0 –

Value based on information presented in the PPL 12 WVA. Specifically, for the Maurepas Diversion Project it was estimated that typical high salinity during the growing season would be about 1.4 ppt. Because the LCA ARDC Modification project is further from the lake (i.e., further from the source of saltwater intrusion) the CWPPRA Environmental Work Group assumed a lower mean high salinity in this area and adopted 1.2 ppt for the PPL 12 WVA.

Future Without Project
Target Years 1 – 50 –

Values based on information presented in the PPL 12 WVA. Specifically, subsidence is expected to continue within the project area over time under the future without project scenario. We, therefore, assume that the ability for saltwater to intrude further and/or more frequently into the project area swamps would likewise increase. Thus, we assumed that mean high salinity during the growing season would increase to 1.4 ppt over 50 years.

Future With Project
Target Years 1 – 50 –

Values based on information presented in the PPL

12 WVA. Specifically, the proposed project was designed to allow for freshwater to be introduced into the swamp when water elevations in the ARDC are higher than in the swamp, which is anticipated to occur frequently. This frequent introduction of freshwater into the system from the ARDC is expected to result in a mean high salinity reduction. However, because the secondary impact areas are located further from the gaps than the primary impact areas and because the volume of water would be spread over a larger area we assumed that mean high salinity benefits would be less in those areas (1.0 ppt for TY 1 and 10). In addition, because of the anticipated increase in sea level rise over time, we assume an increase in mean high salinities of 1.1 and 1.3 ppt for TY 25 and 50, respectively.

Low RSLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	70.88	AAHUs	3544.07	CHUs
• 10 Years to Marsh Primary Impact Area	=	35.22	AAHUs	1761.12	CHUs
• 10 Years to Marsh Secondary Impact Area	=	73.46	AAHUs	3673.10	CHUs
• 20-30 Years to Marsh Primary Impact Area	=	189.49	AAHUs	9474.31	CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	252.42	AAHUs	12621.00	CHUs
• 30-50 Years to Marsh Primary Impact Area	=	27.29	AAHUs	1364.40	CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	40.02	AAHUs	2001.13	CHUs
• Spoil Bank Permanent Impacts	=	-0.55	AAHUs	-27.60	CHUs
• Spoil Bank Temporary Impacts	=	-0.23	AAHUs	-11.38	CHUs
• Fresh Marsh Permanent Impacts	=	-1.33	AAHUs	-66.42	CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.71	AAHUs	-35.53	CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.70	AAHUs	-235.12	CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.80	AAHUs	-89.89	CHUs
TOTAL	►	**679.46**	**AAHUs**	**33973.18**	**CHUs**

Alternative 39

• Fresh Marsh Primary Impact Area	=	70.88	AAHUs	3544.07	CHUs
• Fresh Marsh Secondary Impact Area	=	46.79	AAHUs	2339.32	CHUs
• 10 Years to Marsh Primary Impact Area	=	74.19	AAHUs	3709.30	CHUs
• 10 Years to Marsh Secondary Impact Area	=	367.18	AAHUs	18359.20	CHUs
• 20-30 Years to Marsh Primary Impact Area	=	414.69	AAHUs	20734.26	CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	423.23	AAHUs	21161.60	CHUs
• 30-50 Years to Marsh Primary Impact Area	=	152.59	AAHUs	7629.30	CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	75.40	AAHUs	3770.16	CHUs
• Spoil Bank Permanent Impacts	=	-1.59	AAHUs	-79.35	CHUs
• Spoil Bank Temporary Impacts	=	-0.77	AAHUs	-38.57	CHUs
• Fresh Marsh Permanent Impacts	=	-1.33	AAHUs	-66.42	CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.99	AAHUs	-49.74	CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-8.92	AAHUs	-445.86	CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-9.71	AAHUs	-485.42	CHUs
TOTAL	►	**1601.64**	**AAHUs**	**80081.84**	**CHUs**

Intermediate RSLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67	CHUs
• 10 Years to Marsh Primary Impact Area	=	34.54	AAHUs	1726.93	CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.45	AAHUs	3372.29	CHUs
• 20-30 Years to Marsh Primary Impact Area	=	183.48	AAHUs	9174.00	CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	232.49	AAHUs	11624.65	CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.58	AAHUs	1329.14	CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.91	AAHUs	1895.65	CHUs
• Spoil Bank Permanent Impacts	=	-0.55	AAHUs	-27.60	CHUs
• Spoil Bank Temporary Impacts	=	-0.23	AAHUs	-11.38	CHUs
• Fresh Marsh Permanent Impacts	=	-1.32	AAHUs	-66.22	CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.66	AAHUs	-32.80	CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.37	AAHUs	-218.27	CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.76	AAHUs	-88.17	CHUs
TOTAL	►	**640.32**	**AAHUs**	**32015.90**	**CHUs**

Alternative 39

□ Fresh Marsh Primary Impact Area	=	66.75	AAHUs	3337.67	CHUs
□ Fresh Marsh Secondary Impact Area	=	42.53	AAHUs	2126.41	CHUs
□ 10 Years to Marsh Primary Impact Area	=	72.75	AAHUs	3637.31	CHUs
□ 10 Years to Marsh Secondary Impact Area	=	337.11	AAHUs	16855.69	CHUs
□ 20-30 Years to Marsh Primary Impact Area	=	408.90	AAHUs	20444.99	CHUs
□ 20-30 Years to Marsh Secondary Impact Area	=	389.82	AAHUs	19491.03	CHUs
□ 30-50 Years to Marsh Primary Impact Area	=	148.64	AAHUs	7432.12	CHUs
□ 30-50 Years to Marsh Secondary Impact Area	=	71.43	AAHUs	3571.43	CHUs
□ Spoil Bank Permanent Impacts	=	-1.59	AAHUs	-79.35	CHUs
□ Spoil Bank Temporary Impacts	=	-0.77	AAHUs	-38.57	CHUs
□ Fresh Marsh Permanent Impacts	=	-1.32	AAHUs	-66.22	CHUs
□ 10 Years to Marsh Permanent Impacts	=	-0.92	AAHUs	-45.92	CHUs
□ 20-30 Years to Marsh Permanent Impacts	=	-8.28	AAHUs	-413.90	CHUs
□ 30-50 Years to Marsh Permanent Impacts	=	-9.52	AAHUs	-476.11	CHUs
TOTAL	►	**1515.53**	**AAHUs**	**75776.57**	**CHUs**

High RSLR

Alternative 33

• Fresh Marsh Primary Impact Area	=	58.99	AAHUs	2949.66	CHUs
• 10 Years to Marsh Primary Impact Area	=	31.57	AAHUs	1578.35	CHUs
• 10 Years to Marsh Secondary Impact Area	=	67.08	AAHUs	3354.07	CHUs
• 20-30 Years to Marsh Primary Impact Area	=	170.56	AAHUs	8528.05	CHUs
• 20-30 Years to Marsh Secondary Impact Area	=	226.61	AAHUs	11330.35	CHUs
• 30-50 Years to Marsh Primary Impact Area	=	26.42	AAHUs	1320.83	CHUs
• 30-50 Years to Marsh Secondary Impact Area	=	37.46	AAHUs	1873.22	CHUs
• Spoil Bank Permanent Impacts	=	-0.55	AAHUs	-27.60	CHUs
• Spoil Bank Temporary Impacts	=	-0.23	AAHUs	-11.38	CHUs
• Fresh Marsh Permanent Impacts	=	-1.30	AAHUs	-64.90	CHUs
• 10 Years to Marsh Permanent Impacts	=	-0.62	AAHUs	-31.24	CHUs
• 20-30 Years to Marsh Permanent Impacts	=	-4.16	AAHUs	-207.75	CHUs
• 30-50 Years to Marsh Permanent Impacts	=	-1.63	AAHUs	-81.71	CHUs
TOTAL	►	**610.20**	**AAHUs**	**30509.94**	**CHUs**

Alternative 39

□ Fresh Marsh Primary Impact Area	=	58.99	AAHUs	2949.66	CHUs
□ Fresh Marsh Secondary Impact Area	=	40.91	AAHUs	2045.66	CHUs
□ 10 Years to Marsh Primary Impact Area	=	66.49	AAHUs	3324.36	CHUs
□ 10 Years to Marsh Secondary Impact Area	=	335.10	AAHUs	16754.90	CHUs
□ 20-30 Years to Marsh Primary Impact Area	=	373.27	AAHUs	18663.39	CHUs
□ 20-30 Years to Marsh Secondary Impact Area	=	379.95	AAHUs	18997.57	CHUs
□ 30-50 Years to Marsh Primary Impact Area	=	147.71	AAHUs	7385.67	CHUs
□ 30-50 Years to Marsh Secondary Impact Area	=	70.58	AAHUs	3529.16	CHUs
□ Spoil Bank Permanent Impacts	=	-1.59	AAHUs	-79.35	CHUs
□ Spoil Bank Temporary Impacts	=	-0.77	AAHUs	-38.57	CHUs
□ Fresh Marsh Permanent Impacts	=	-1.30	AAHUs	-64.90	CHUs
□ 10 Years to Marsh Permanent Impacts	=	-0.87	AAHUs	-43.74	CHUs
□ 20-30 Years to Marsh Permanent Impacts	=	-7.88	AAHUs	-393.96	CHUs
□ 30-50 Years to Marsh Permanent Impacts	=	-8.82	AAHUs	-441.21	CHUs
TOTAL	►	**1451.77**	**AAHUs**	**72588.63**	**CHUs**

WVA Data

Figure 1 depicts the acreages utilized as input for the WVA model. These acreages represent each habitat type (20-30 years to marsh, marsh, etc.) separated out into the primary and secondary impact areas for the final array of alternatives.

Figures 2 – 6 depict the construction footprint in acres for the bifurcated conveyance channels implemented within the final array of alternatives.

Primary and Secondary Impact Areas

The primary and secondary impact areas for the final array of alternatives were developed after examining existing conveyance channels found within the study area. These channels are considered to be in a state of hydrologic equilibrium due to the lack of sediment buildup observed, when compared to other channels found within the same general area. The benefit areas for the proposed conveyance channels were developed by observing the dimensions and configurations of the drainage areas found along these existing channels.

The primary impact area would have more flow exchange and therefore more sediments and nutrients than the secondary impact area. The volume of water, which transports sediments and nutrients, is dependent on the duration of high stages in the ARDC. During the short duration of high stages in the ARDC, the benefits may be limited to the primary impact area. During normal hydrologic cycles, the primary impact area would receive a higher flow exchange than the secondary impact area.

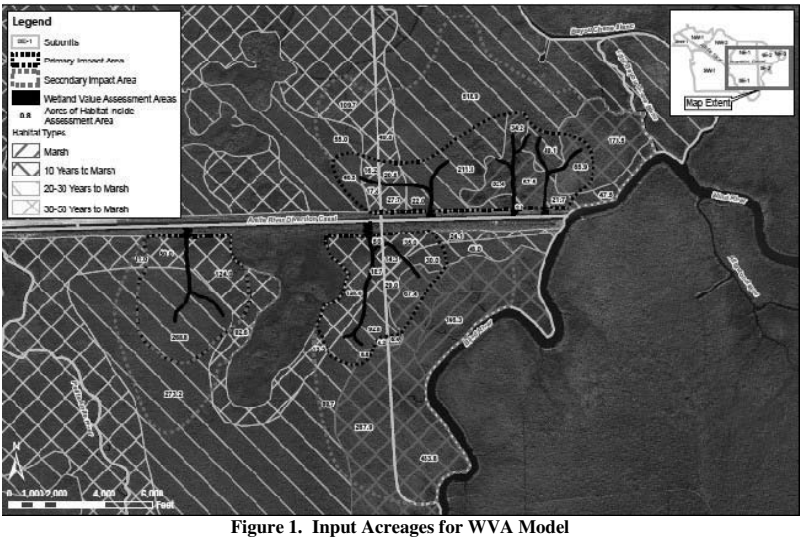


Figure 1. Input Acreages for WVA Model

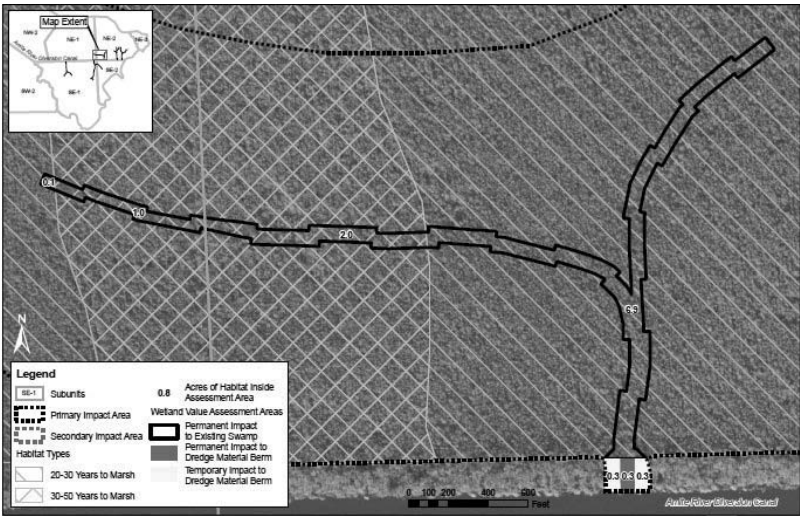


Figure 2. WVA Acreages for Alternative 33 Cut A

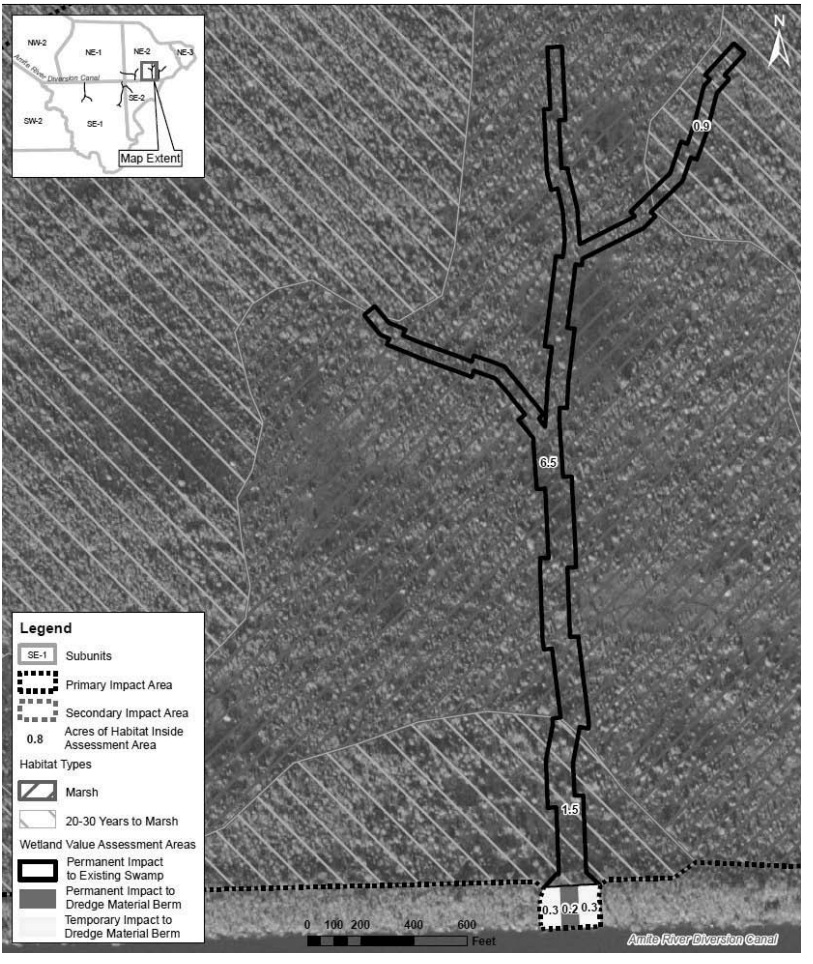


Figure 3. WVA Acreages for Alternative 33 Cut B

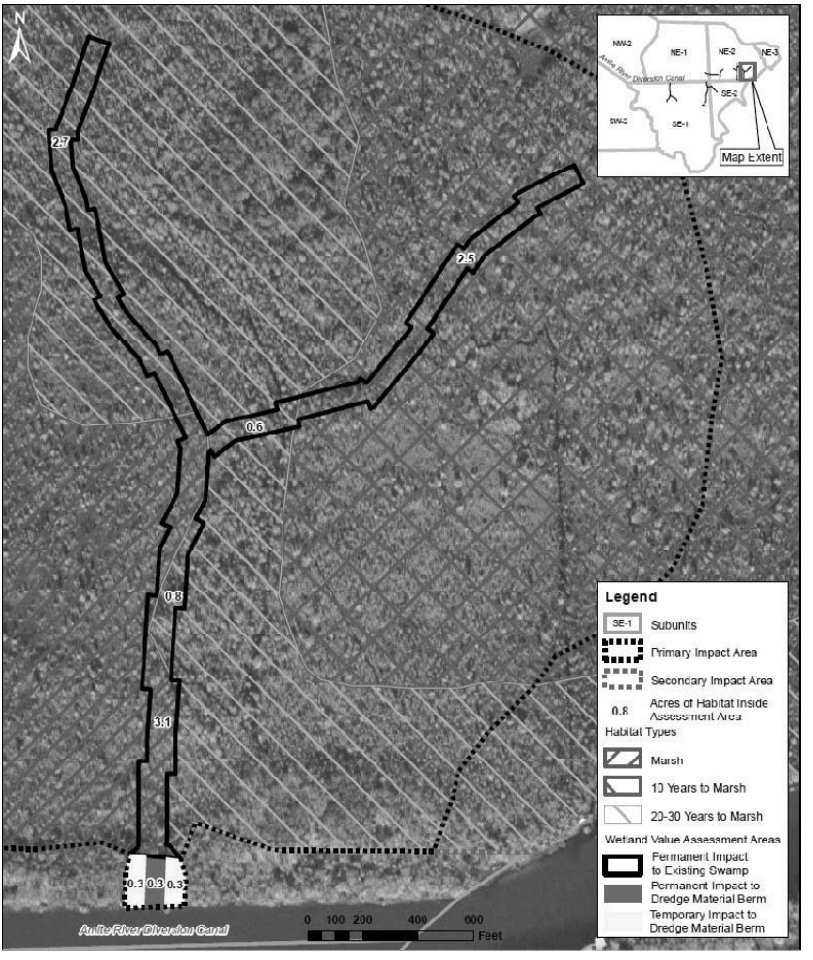


Figure 4. WVA Acreages for Alternative 33 Cut C

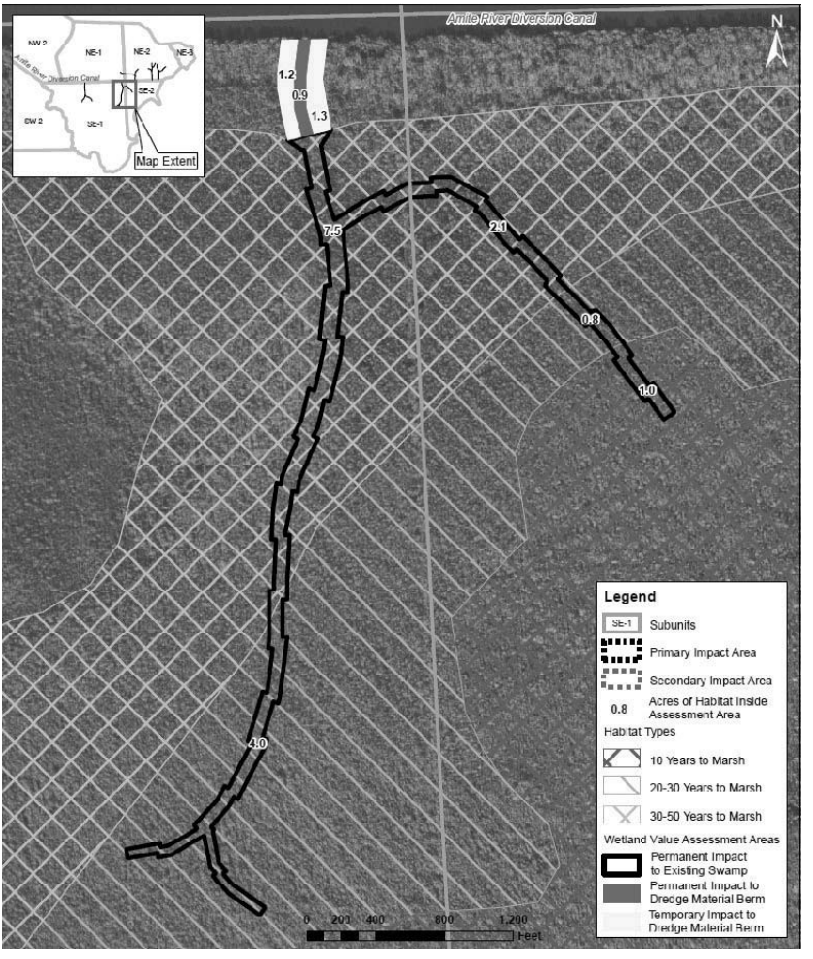


Figure 5. WVA Acreages for Alternative 34

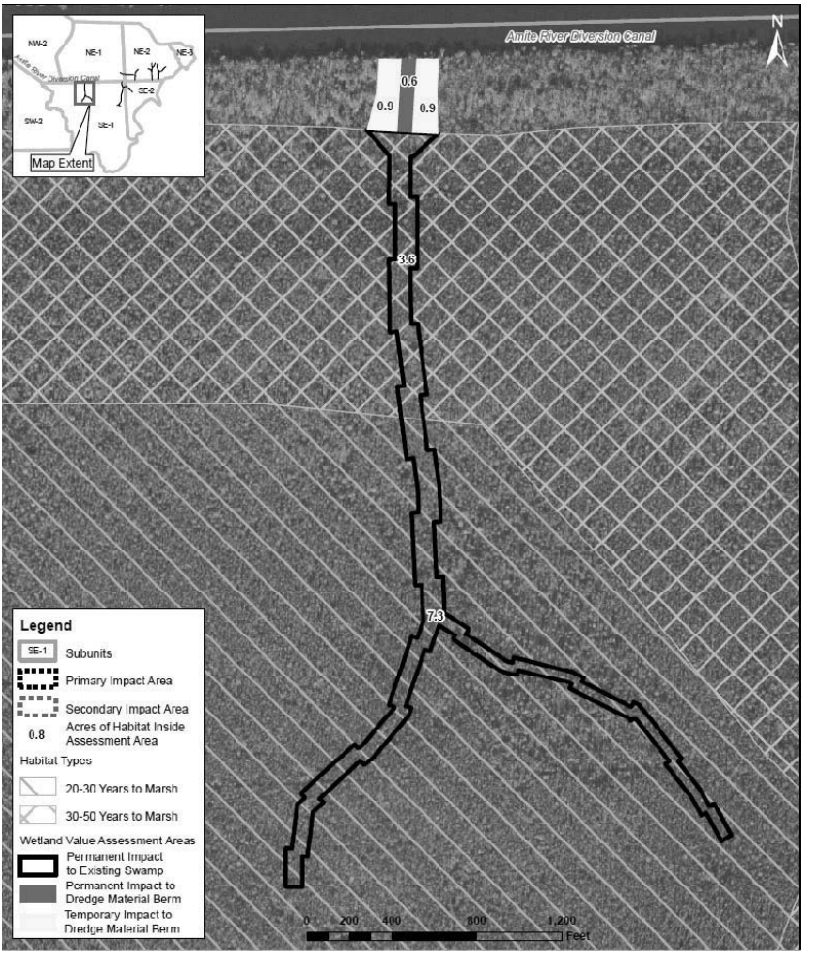
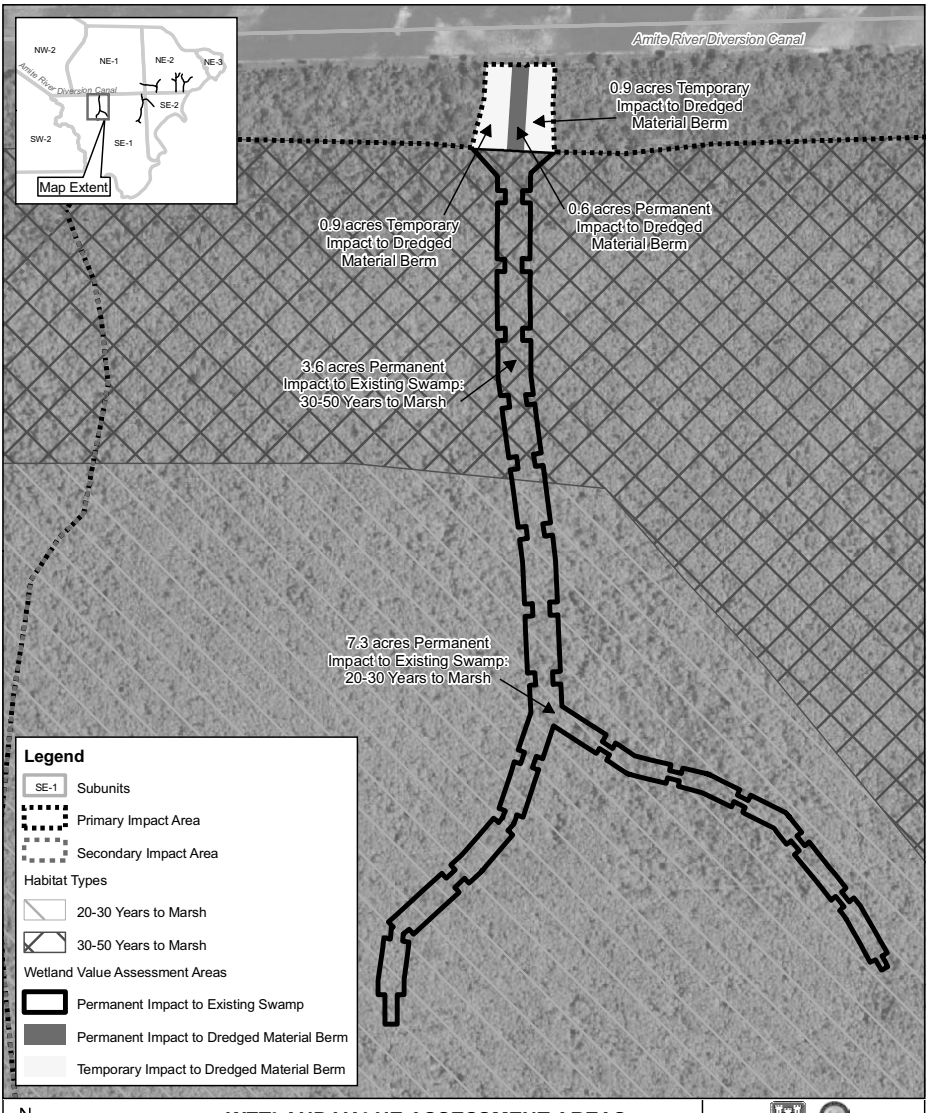


Figure 6. WVA Acreages for Alternative 35



WETLAND VALUE ASSESSMENT AREAS FOR ALTERNATIVE 35

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 6
Date: February 2010
Scale: 1:6,000
Source: USGS/GEC
Map ID: 27850108-1859

Summary of acreages for each alternative by habitat type used in the WVA and benefits analysis

	Construction Area									Benefits Area										
	Dredged Material Berm			Existing Swamp (Permanent)						Primary Impact Area					Secondary Impact Area					
Alternative	Permanent	Temporary	Sub Total	Marsh	10 Years to Marsh	20-30 Years to Marsh	30-50 Years to Marsh	Sub Total	Total	Existing Marsh	10 Years to Marsh	20-30 Years to Marsh	30-50 Years to Marsh	Sub Total	Existing Marsh	10 Years to Marsh	20-30 Years to Marsh	30-50 Years to Marsh	Sub Total	Total for Benefits Areas
33 Cut A	0.3	0.6	0.9	0.0	0.0	7.0	3.0	10.0	11.8											
33 Cut B	0.2	0.6	0.8	6.5	0.0	2.4	0.0	8.9	10.5											
33 Cut C	0.3	0.6	0.9	3.1	2.5	4.1	0.0	9.7	11.5											
33	0.8	1.8	2.6	9.6	2.5	13.5	3.0	28.6	**31.2**	144.1	65.9	353.9	81.8	**645.7**	0.0	175.5	621.4	159.5	**956.4**	**1,602.1**
34	0.9	2.5	3.4	0.0	1.0	4.8	9.6	15.4	**18.8**	0.0	72.9	151.8	201.6	**426.3**	146.3	701.7	147.3	37.4	**1,032.7**	**1,459.0**
35	0.6	1.8	2.4	0.0	0.0	7.3	3.6	10.9	**13.3**	0.0	0.0	268.8	174.0	**442.8**	0.0	0.0	273.2	103.6	**376.8**	**819.6**
36	1.7	4.3	6.0	9.6	3.5	18.3	12.6	44.0	**50.0**	144.1	138.8	505.7	283.4	**1,072.0**	146.3	877.2	768.7	196.9	**1,989.1**	**3,061.1**
37	1.5	4.3	5.8	0.0	1.0	12.1	13.2	26.3	**32.1**	0.0	72.9	420.6	375.6	**869.1**	146.3	701.7	420.5	141.0	**1,409.5**	**2,278.6**
38	1.4	3.6	5.0	9.6	2.5	20.8	6.6	39.5	**44.5**	144.1	65.9	622.7	255.8	**1,088.5**	0.0	175.5	894.6	263.1	**1,333.2**	**2,421.7**
39	2.3	6.1	8.4	9.6	3.5	25.6	16.2	54.9	**63.3**	144.1	138.8	774.5	457.4	**1,514.8**	146.3	877.2	1,041.9	300.5	**2,365.9**	**3,880.7**

1059

WVA Model Certification--Comments and Responses

1. Starting the SI curves for all variables at 0.1 is problematic because even habitat with no ecological value appears to have some ecological value. The WVA swamp model has only two graphs. One of them, V2 - Stand Maturity, has a zero intercept. The other, Salinity, does not. However, McKay and Fischenich (1) did a sensitivity analysis on the Barataria Barrier Shoreline WVA. Their study showed that the application of the zero slope intercept instead of 0.1 as in the model did not affect the relative rankings of any of the alternatives. The same is likely to be true for the ARDC Modification project.

3. The number of target years should be increased to improve the predictive ability of the models given that changes are often non-linear. For the LCA ARDC Modification project, different alternatives were analyzed using target years depending upon various assumptions such as the health of the vegetation relative to similar vegetation in the swamp outside of the project area as reflected in the habitat classification map (20-30 years to marsh, 30-50 years to marsh, and >50 years to marsh). The target years (TY) used for the LCA ARDC Modification project were TY0, TY1, TY20, TY30, and TY 50.

For the WVA Certification, additional text has been provided in the Procedural Manual to guide users on the selection of target years. A table has been added summarizing, by project type, the use of specific target years to reflect aspects of project evolution. Suggestions have been made for ensuring the justification for the selection of target years is added to the Project Information Sheet.

4. In the spreadsheet for the marsh model, open water and emergent marsh AAHUs are incorrectly combined and should be added rather than taking the arithmetic mean. The marsh models were not used in the LCA ARDC Modification project.

6. Sea level is an important driver and relative sea level rise and climate change should be included in the models. For the LCA ARDC Modification project, relative sea level and subsidence were accounted for in the land loss rates calculated for each project area. Data in the literature indicated that the rate of accretion will offset sea level rise and subsidence. The hydrologic modeling that was used to evaluate WVA metrics for the ARDC used the intermediate rate of sea level rise.

For WVA Certification, a new section 'Climate Change' has been added to the Procedural Manual to provide guidance on how to consider sea-level rise and other climate change effects in the evaluation. Suggestions have been made to document in the Project Information Sheet how these factors are considered in the evaluation.

10. For some model variables, policy decisions appear to supersede the biology of the relationships for developing the Suitability Index (SI) curves. This comment referred to a problem that the reviewers had with the marsh models. The marsh models were not used in the LCA ARDC Modification project.

11. The spreadsheets for the models as created are likely to lead to errors in maintenance and use. The United States Fish and Wildlife Service (USFWS) Habitat Evaluation Team (HET) member for the LCA ARDC Modification project is experienced in the use of WVA spreadsheets. To ensure that "% cover" and "class," as well as other spreadsheet numbers were entered correctly, the spreadsheet entries have been and will be reviewed by several members of the HET (e.g., agency representatives).

For WVA Certification, the spreadsheets have been corrected as Battelle suggested to correct calculation errors, improve the spreadsheet user interface, and decrease the likelihood of user errors.

12. Several inaccuracies were identified in the model spreadsheets that should be corrected. As explained above, the USFWS HET member is experienced in the use of WVA spreadsheets and the HET reviewed all spreadsheets. According to model developers, the spreadsheet works correctly for the Swamp WVA V2.

For WVA Certification, the spreadsheets have been corrected as Battelle suggested to correct calculation and specification errors.

15. The WVA method should be expanded to handle risk and uncertainty in areas exposed to episodic events. Risk and uncertainty are already incorporated into the WVA model used for the LCA ARDC Modification project. Risk and uncertainty are also addressed in Section 3.8 of the Integrated Feasibility Study and Draft Supplemental Environmental Impact Statement (DSEIS) and include hydrologic, environmental, and construction and economic uncertainties.

For WVA Certification, suggestions have been made to add a section to the Project Information Sheet to describe how risk and uncertainty are considered in the evaluation.

16. The WVA method should be updated, taking into account new GIS data, LIDAR, and other new data sources as well as model formats/presentation (visualization tools, HGM). The WVA model used for the LCA ARDC Modification project included the use of the most recent imagery and land loss data available from the (U.S. Geological Survey) USGS as well as the most appropriate historic imagery to determine land loss and habitat conversion. The habitat classification map was developed by scientists with the most knowledge about the condition of wetlands in Maurepas Swamp in conjunction with the most recent available imagery from the USGS.

For WVA Certification, the Procedural Manual has been updated to reflect current use and to provide appropriate guidance on available data sources.

18. The use of the geometric mean may be more appropriate than the arithmetic mean to derive some HSIs. Provide scientific basis for the decision. The WVA Swamp Model used for the LCA ARDC Modification project uses a geometric mean to derive HSIs.

SECTION 2

LOUISIANA COASTAL AREA
AMITE RIVER DIVERSION CANAL MODIFICATION
INTEGRATED FEASIBILITY STUDY AND
ENVIRONMENTAL IMPACT STATEMENT

IWR CE/ICA ANALYSIS

ECONOMICS APPENDIX
APPENDIX K

Cost Effective and Incremental Cost Analyses

Introduction

For environmental planning, where traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units, two analytical methods are used to assist Corps planners in the decision process. First, cost effectiveness analysis is conducted to ensure that the least cost solution is identified for each possible level of environmental output. Subsequent incremental cost analysis of the cost effective solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. In the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost effectiveness and incremental cost analysis are valuable tools to assist in decision making.

It is important to keep in mind that the most useful information developed by these two methods is what it tells decision makers about the relative relationships among solutions – that one would likely produce greater output than another, or one is likely to be more costly than another – rather than the specific numbers that are calculated. Furthermore, these analyses would usually not lead, and are not intended to lead, to a single best solution (as in economic cost-benefit analysis); however, they would improve the quality of decision making by ensuring that a rational, supportable approach is used in considering and selecting alternative methods to produce environmental outputs.

The cost-effectiveness and incremental cost analyses are performed with the Institute of Water Resources IWR-Plan software. This software takes the annualized costs, as determined by a preliminary cost estimate, and the annualized benefits (Average Annual Habitat Units) (AAHUs), as determined by the Wetland Value Assessment (WVA) model, for each of the alternatives in the final array, including the No-Action Alternative. From this data, an analysis of cost-effectiveness and incremental cost is run between each alternative, at which point the software determines if any of the alternatives are determined to be cost-effective. A cost-effective alternative is one which produces the greater benefits (AAHUs) with the same cost as other alternatives. From this analysis, a frontier is formed on the cost benefit plot (Figure 1). Anything above this frontier is considered cost-effective. Additionally, an incremental cost analysis is run between each of the alternatives included in the IWR Planning Suite analysis. The incremental cost analysis compares the differential in cost and benefits (the slope of the line connecting two alternatives on the cost/benefit plot) for each alternative to the alternatives with similar cost and benefit characteristics. The alternatives which exhibit comparably greater differentials are characterized as a Best Buy. A Best Buy represents the alternatives with maximized incremental benefit to cost increase when compared to the previous incremental benefit and cost comparison.

Amite River Diversion Canal Modification

This study evaluated several alternatives designed to restore freshwater swamp habitat within the western Maurepas Swamp, which is recognized as a vital national resource.

The intent is to restore the degraded areas within the study area by restoring hydrologic connectivity, increasing nutrient and sediment input into the areas of impact and to promote the healthy regeneration of cypress/tupelo swamp habitat. In this analysis, eight environmental restoration alternatives are being evaluated. These alternatives include the No-Action Alternative, along with Alternatives 33 through 39. Alternatives 33, 34, and 35 are considered stand-alone alternatives, while Alternatives 36 through 39 are combinations of the aforementioned stand-alone alternatives. Therefore, the final array represents all possible combinations of Alternatives 33, 34, and 35. It should also be noted that, based on feedback from Dr. Gary Shaffer of the University of Southeastern Louisiana, vegetative plantings are considered a critical component of the restoration process. Therefore, vegetative plantings were included in all alternatives proposed in the most-highly degraded areas in the study area (Alternative 33 and 34). Table K.1 displays the expected environmental outputs in terms of average annual habitat units, the annualized costs for each restoration alternative, and the annualized cost per AAHU. Average annual costs (reflecting 2008 price levels) were calculated using the Federal discount rate of 4.375 percent and assuming a 50-year period of analysis.

Table 1. Cost and Benefit Breakdown for Final Array of Alternatives

Alternative	Acres of Benefit	AAHUs	Total Construction Cost	Annualized Cost**	Annualized Cost/AAHU
35*	820	334	$1,090,000	$61,000	$180
38*	2,422	1,013	$4,550,000	$236,000	$230
37	2,279	922	$4,210,000	$217,000	$240
39*	3,881	1,602	$7,700,000	$394,000	$250
36	3,061	1,268	$6,870,000	$352,000	$280
33	1,602	679	$3,780,000	$197,000	$290
34	1,459	589	$3,370,000	$174,000	$300

*Best Buy
** Discount Rate of 4.375% used over six-year construction period

IWR Results

The results of the IWR-Plan Software Suite analysis determined that all eight of the restoration alternatives are considered cost-effective (Table 2). In addition, the No-Action Alternative, Alternative 35, Alternative 38, and Alternative 39 were designated as Best Buys. By default, the No-Action Alternative and the alternative with the maximum output (Alternative 39) are considered Best Buys by the IWR-Plan Software Suite. Therefore, it is evident that there is not a significant difference in the incremental cost to incremental benefit ratio between the other six restoration alternatives. Figure 1 represents the cost-effective frontier of the eight proposed restoration alternatives. Figure 2 depicts a plot of annualized costs vs. annualized benefits for all eight alternatives analyzed.

Table 2. IWR Results

Alternative	Annualized Cost	Output (AAHUs)	Cost Effective?
No Action Plan	$0	0	Best Buy
35	$61,000	334	Best Buy
34	$174,000	589	Yes
33	$197,000	679	Yes
37	$217,000	922	Yes
38	$236,000	1013	Best Buy
36	$351,000	1268	Yes
39	$394,000	1602	Best Buy

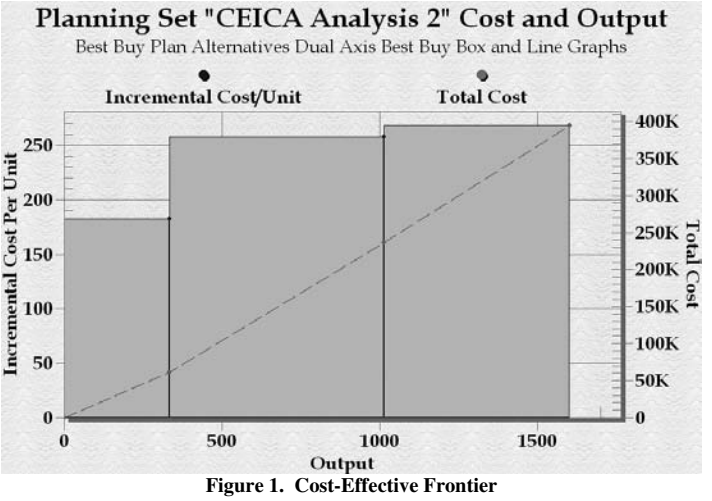


Figure 1. Cost-Effective Frontier

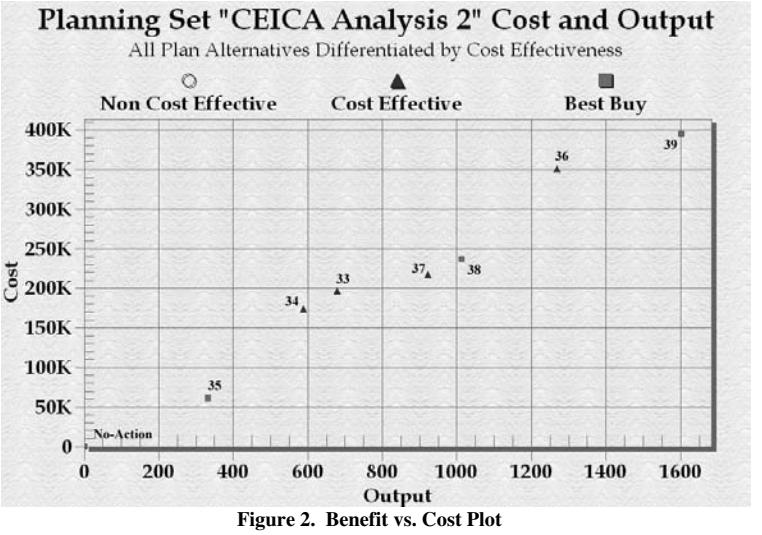


Figure 2. Benefit vs. Cost Plot

Background of CE/ICA Analysis

The following analysis is based on an Environmental Studies report produced by the US Army Corps of Engineers entitled, "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps." The analysis was started at Step 4 (since the Array of Alternatives has already been determined) as directed by the document.

Step 4: None of the alternatives have the same output; therefore they are **All Cost Efficient**.

Step 5: All are Cost Effective

Table 1: Step 5 – Cost Effective Solutions

Alternative	Output (AAHUs)	Annualized Cost (AAC)	Cost Effective?
No-Action	0	$0	Yes
35	334	$60,956	Yes
34	589	$173,671	Yes
33	679	$196,686	Yes
37	922	$217,220	Yes
38	1013	$236,293	Yes
36	1268	$351,365	Yes
39	1602	$394,171	Yes

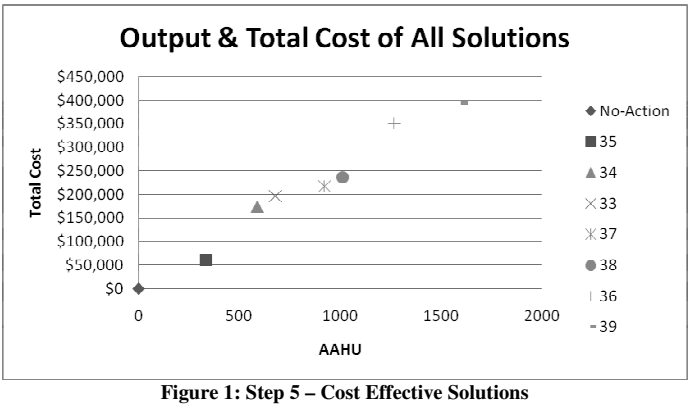


Figure 1: Step 5 – Cost Effective Solutions

Step 6: Calculate Average Costs

Table 2: Step 6 – Average Costs

Alternative	Output (AAHUs)	Annualized Cost (AAC)	AAC/AAHU	
No-Action	0	$0	$0	← Dropped from Further Analysis
35	334	$60,956	$182.50	← Lowest Average Cost
34	589	$173,671	$294.86	
33	679	$196,686	$289.67	
37	922	$217,220	$235.60	
38	1013	$236,293	$233.26	
36	1268	$351,365	$277.10	
39	1602	$394,171	$246.05	

Step 7: Average Costs for Additional Output

Table 3: Step 7A – First Recalculation

Alternative	Output (AAHUs)	Additional Output (AAHU)	Annualized Cost	Average Cost for Additional Output
35	334	0	$60,956	---
34	589	255	$173,671	$442
33	679	345	$196,686	$393
37	922	588	$217,220	$266
38	1013	679	$236,293	$258
36	1268	934	$351,365	$311
39	1602	1268	$394,171	$263

Table 4: Step 7B – Second Recalculation

Alternative	Output (AAHUs)	Additional Output (AAHU)	Annualized Cost	Average Cost for Additional Output
38	1013	0	$236,293	---
36	1268	255	$351,365	$451
39	1602	589	$394,171	$268

Table 5: Step 7C – Summary of Results

Average Cost for Additional Output			
Alternative	**Original**	**Step 7A**	**Step 7B**
No-Action	-		
35	$183	---	
34	$295	$442	
33	$290	$393	
37	$236	$266	
38	$233	$258	---
36	$277	$311	451.26275
39	$246	$263	268.04414

Table 6: Step 7D – Solutions with Lowest Average Costs for Additional Output

Alternative	Output (AAHUs)	Annualized Cost
No-Action	0	$0
35	334	$60,956
38	1013	$236,293
39	1602	$394,171

Step 8: Calculate Incremental Costs

Table 7: Step 8A –Incremental Costs

Alternative	Output (AAHUs)	Annualized Cost	Additional Output (AAHU)	Additional Annualized Cost	Incremental Cost ($ per AAHU)
No-Action	0	$0	---	---	---
35	334	$60,956	334	$60,956	$183
38	1013	$236,293	679	$175,337	$258
39	1602	$394,171	589	$157,878	$268

Table 8: Step 8B – Solutions with Lowest Average Costs for Additional Output

Alternative	Output (AAHUs)	Annualized Cost	Incremental Cost ($ per AAHU)
No-Action	0	$0	---
35	334	$60,956	$183
38	1013	$236,293	$233
39	1602	$394,171	$246

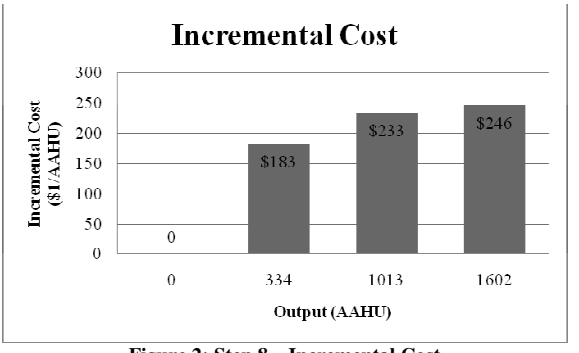


Figure 2: Step 8 – Incremental Cost

Step 9: Comparison and Justification of Successive Incremental Outputs and Costs

Table 9: Step 9 – Justification

Alternative	Output (AAHUs)	Annualized Cost	Additional Output (AAHU)	Additional Annualized Cost	Incremental Cost ($ per AAHU)	Justified? Worth It?
No-Action	0	$0	---	---	---	
35	334	$60,956	334	$60,956	$183	Yes
38	1013	$236,293	679	$175,337	$258	Yes
39	1602	$394,171	589	$157,878	$268	Yes

APPENDIX L
ENGINEERING APPENDIX

Appendix L
ENGINEERING

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Section 1

INTRODUCTION

Introduction

This Engineering Appendix outlines the engineering and design work done to support the preparation of the Integrated Feasibility Report and Environmental Impact Statement for the Louisiana Coastal Area (LCA) - Amite River Diversion Canal (ARDC) Modification Element of the Section 7006(e)(3) Ecosystem Restoration Projects Study in Ascension and Livingston Parishes, Louisiana.

Background

The study area contains approximately 19,000 acres of bald cypress-tupelo swamp habitat in the western Maurepas Swamp. The area includes the ARDC, a 10.6-mile-long flood control channel between the Amite and Blind Rivers which was completed in 1964. Dredged material excavated during channel construction was deposited in spoil banks on either side of the canal. These spoil banks have disrupted the natural hydrologic regime in the proposed study area, resulting in a reduction in biomass production and soil accumulation as well as an increase in relative subsidence.

Prior studies have documented degradation in the bald cypress-tupelo swamp adjacent to the ARDC and have demonstrated a need for ecosystem restoration of this swamp habitat through the reconnection of a natural hydrologic regime. The proposed project involves restoration of impaired swamp habitat within the study area by gapping the spoil banks along the ARDC, promoting hydrologic exchange between flows within the ARDC and the adjacent swamp habitat.

Without implementation of the proposed project, the bald cypress-tupelo swamps within the study area would convert to unstable freshwater marsh, which in turn would convert to open water. Prior studies have estimated that without implementation of the proposed project, canopy cover within the study area would degrade to less than 33 percent within 20 years and 50 percent of the swamp habitat would be lost within 60 years.

Project Objectives

The purpose of the ARDC Modification project is to restore the ecosystem in the ARDC area on the adjacent bald cypress-tupelo swamp habitat by gapping the existing spoil banks on either side of the canal. The proposed project will be evaluated for its potential to prevent future bald cypress-tupelo swamp degradation and conversion, to restore sheet flow impaired by the dredged material berm, and to protect vital socioeconomic and public resources.

The proposed project would work independently of, but synergistically with, other LCA near-term critical features. This includes the LCA Small Diversion at Hope Canal, LCA Small Diversion at Convent/Blind River, coastal restoration projects proposed under other authorities, including the Livingston Parish Coastal Impact Assistance Program (CIAP) project Hydrologic Restoration in Swamps West of Lake Maurepas, the U.S. Army Corps of Engineers (USACE)

project Comite River Diversion, and the Pontchartrain Levee District (PLD) project Amite River and Tributaries Ecosystem Restoration Feasibility Study. Together these projects would provide a holistic approach to restoration of impaired swamp habitat throughout the western Maurepas Swamp. The goal of this project is to reverse the trend of degradation in the western portion of the Maurepas Swamp, contribute to the overall goal of achieving a sustainable coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus the Nation. Project objectives include the following:

- Prevent habitat conversion and future land loss;
- Establish hydrologic connectivity to allow for seasonal wetting and drying, so that the swamps are drained, promoting seedling germination, establishment, and survival;
- Introduce nutrient and sediment to swamps;
- Promote water circulation to improve water quality;
- Increase swamp vegetation productivity;
- Restore and preserve fish and wildlife habitat; and
- Protect vital socioeconomic resources including cultures, community, infrastructure, business and industry, and flood protection features;
- Vegetative planting and nutria control.

Section 2

HYDRAULICS AND HYDROLOGY

Section 2

HYDRAULICS AND HYDROLOGY

GENERAL

Biological, topographical, and hydrological data was collected as needed to support the development of a hydrologic and hydraulic (H&H) model that was used to characterize existing conditions and model the future-without-project scenario as well as future-with-project scenarios. The model is a one-dimensional, unsteady-state Hydraulic Engineering Centers River Analysis System (HEC-RAS) model to simulate water levels and movement within the project area. The model is intended to answer the following concerns regarding the proposed gapping alternatives:

- Whether water will leave the conveyance channel and flow to and from the swamp;
- The effect of the proposed gapping on the hydraulics and water levels in a portion of the swamp;
- The effect of the proposed gapping on flood risk in the study area.

ANNEX

Hydraulics and Hydrology

H&H Modeling Summary

Taylor Engineering used the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) program to model the No Action Plan and the With Project Plan. The development of the models is to simulate the flow in the proposed channels and stage duration data in the benefit areas.

Due to time and funding constraints for this study, HEC-RAS (1-D, unsteady state) was selected for the analysis. Due to the accelerated schedule for the project, only existing data was used; no new stage data was collected. The HEC-RAS model was used to support the WVA of the proposed project. The model results are used to quantify flow/exchange and flooding duration (Variable V_3) in the WVA calculations.

HEC-RAS Model Calibration

The HEC-RAS unsteady state routine simulates channels and adjacent floodplain swamps as a one-dimensional hydrodynamic system. Taylor Engineering used U. S. Geological Survey (USGS) stream gage data for the upstream boundary condition (inflow hydrograph) and for the downstream boundary condition (stage hydrograph). During the calibration process, the initial attempts to calibrate the model used a channel and vertical N-values. N-values were adjusted to very high values in an attempt to simulate observed flow patterns. The computed stages in the storage areas were compared to gage data in the swamp. The best fit of the computed stages when compared to the gage data was achieved when the flow between the ARDC and the swamp was simulated using a culvert for low flow and a weir to simulated high flow conditions. No data was available to validate the model. Chapter 2 describes the development of the HEC-RAS model, calibrated with 2005 data from two Louisiana Coastal Protection and Restoration Authority (CPRA) swamp gages.

HEC-RAS Model Simulation of Alternative Plans The HEC-RAS models were developed and used to support the WVA. Water Regime (variable V3) in the WVA considers the flood duration and the flow/exchange. The flooding duration categories are Seasonal, Temporary, Semi-permanent, and Permanent. The Flow/Exchange categories are High, Moderate, Low, and None. Output data from the HEC-RAS was used to estimate the consecutive number of days was used as an indicator of flood duration and the computed discharge in the proposed channels was used as an indicator for the flow/exchange.

To simulate the No Action Plan and the ARDC modification, Taylor Engineering conducted long-term hydrologic simulations of the study area based on average daily discharge and daily stages for the 10-year period from January 1, 1999 to December 31, 2008. Extracted estimates of flood and drying days established the current or baseline conditions needed to evaluate the proposed alternatives. Chapter 3 describes the HEC-RAS modeling for the No Action Plan and the With Project Plan, which represented seven different alternatives, and presents the results.

Tables 1 through 3 present model results for the No Action Plan and the With Project Plan. Table 1 presents a summary of the computed flows in the exchange channels. Tables 2 and 3 present a comparison of stage duration (in days) for the swamp storage areas in SE-1 and NE-2. Table 2 combines results for the two exchange channels in this area. Table 2 shows that the With Project Plan increases the percentage of days in SE-1 with Water Surface Elevation (WSE) at or below 1.0 foot from 6 to 37%. Table 3 shows the With Project Plan increases the number of days with WSE at or below 1.0 foot from 7 to 48% in NE-2.

Table 1 Computed Flow

With Project (no flow in the No Action Plan)					
Exchange Channel	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6330	5298	4812	4368	4035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6874	7160	3392	3696	4088
% time of outflow	77%	78%	71%	72%	72%

Table 2 Stage Duration, Storage Area SE-1

No Action						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	213	2283	2742	2935	3059	3151
% time at or below WSE	6%	62%	75%	80%	84%	86%
Consecutive Days at or below WSE	73	120	138	164	203	204
With Project						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	1352	2390	2770	2950	3070	3160
% time at or below WSE	37%	65%	76%	81%	84%	86%
Consecutive Days at or below WSE	114	121	152	164	203	205

Table 3 Stage Duration, Storage Area NE-2

No Action						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	241	2306	2834	3027	3144	3233
% time at or below WSE	7%	63%	78%	83%	86%	88%
Consecutive Days at or below WSE	64	148	184	203	204	205

With Project						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	1750	2501	2865	3032	3153	3236
% time at or below WSE	48%	68%	78%	83%	86%	89%
Consecutive Days at or below WSE	117	150	185	204	204	205

Relative Sea Level Rise

Taylor Engineering evaluated the potential hydrologic impact on the No Action Plan and the modification alternatives for estimates of relative sea level rise (RSLR) in accordance with guidance provided by the USACE, New Orleans District. Chapter 4 describes the analysis of RSLR effects on the alternative plans and provides the results.

Taylor Engineering reran the HEC-RAS models for the No Action Plan and the With Project Plan for 2061 (Year-50) for the three RLSR cases by adding 1.5, 1.9, and 3.2 feet to the Amite River at Maurepas hydrograph downstream boundary condition. Tables 4, 5, and 6 present model results. Table 4 includes the previous results (Year 1) for computed flows in the exchange channels versus computed Year 50 flows for low, intermediate, and high RSLR. Tables 5 and 6 provide similar comparisons of stage durations for the previously computed Year 1 versus Year 50 low, intermediate, and high RSLR for the No Action Plan and With Project Plan in SE-1 and NE-2, respectively.

Table 4 demonstrates that as stages increase in Lake Maurepas due to RSLR, the flow in the proposed new exchange channels increase.

Tables 5 and 6 show that RSLR will dramatically reduce the stage duration below 1.0 foot with both the No Action Plan and the With Project Plan. The percentage of days with WSE below 1.0 foot in the SE-1 and NE-2 areas falls from 37 and 48%, respectively, to zero under all three RSLR cases.

Table 4 Computed Exchange Channel Flows with RSLR

With project with no RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6330	5298	4812	4368	4035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6874	7160	3392	3696	4088
% time of outflow	77%	78%	71%	72%	72%
With Project with 50 years of Low rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	23175	20734	14522	13503	12903
% time of inflow	35%	34%	54%	53%	52%
Volume outflow (ac-ft/yr)	32635	35202	7291	8187	8894
% time of outflow	65%	66%	46%	47%	48%
With Project with 50 years of Intermediate rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	28332	25659	15172	14131	13480
% time of inflow	36%	35%	56%	55%	54%
Volume outflow (ac-ft/yr)	41868	45382	7324	8397	9234
% time of outflow	64%	65%	44%	45%	46%
With Project with 50 years of High rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	36013	33138	15622	14617	14028
% time of inflow	39%	38%	56%	54%	52%
Volume outflow (ac-ft/yr)	57802	63338	74145	9374	11222
% time of outflow	61%	62%	44%	46%	48%

Table 5 Stage Duration with RSLR, Storage Area SE-1

	No Action Plan						With Project Plan					
Without RSLR												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	213	2283	2742	2935	3059	3151	1352	2390	2770	2950	3070	3160
% time at or below WSE	6%	62%	75%	80%	84%	86%	37%	65%	76%	81%	84%	86%
Consecutive Days at or below WSE	73	120	138	164	203	204	114	121	152	164	203	205
With Project with Low rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	15	60	89	120	0	8	62	104	162	206
% time at or below WSE	0%	0%	0%	2%	2%	3%	0%	0%	2%	3%	4%	6%
Consecutive Days at or below WSE	0	0	2	7	9	12	0	2	7	10	16	22
With Project with Intermediate rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	3	7	0	0	3	12	24	38
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Consecutive Days at or below WSE	0	0	0	0	1	2	0	0	1	3	3	3
With Project with High rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0

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Table 6 Stage Duration with RSLR, Storage Area NE-2

	No Action Plan						With Project Plan					
Without RSLR												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	241	2306	2834	3027	3144	3233	1750	2501	2865	3032	3153	3236
% time at or below WSE	7%	63%	78%	83%	86%	88%	48%	68%	78%	83%	86%	89%
Consecutive Days at or below WSE	64	148	184	203	204	205	117	150	185	204	204	205
With Project with Low rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	2	63	140	205	285	0	11	77	144	214	289
% time at or below WSE	0%	0%	2%	4%	6%	8%	0%	0%	2%	4%	6%	8%
Consecutive Days at or below WSE	0	2	8	12	17	22	0	5	8	12	17	22
With Project with Intermediate rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	1	19	40	60	0	0	4	23	42	66
% time at or below WSE	0%	0%	0%	1%	1%	2%	0%	0%	0%	1%	1%	2%
Consecutive Days at or below WSE	0	0	1	3	3	8	0	0	2	3	3	5
With Project with High rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1	1.1	1.2	1.3	1.4	1.5	1	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0

Table 7 presents estimates of the time in years to permanent inundation for the No Action Plan and With Project Plan (conditions are nearly the same for both swamp areas). These estimates do not consider a rate for biomass and mineral sediment accretion. Biomass and mineral sediment accretion could extend the timeline until permanent inundation.

Table 7 Years to Permanent Inundation

RSLR Case	RSLR Year 50	No Action	With Project
Low Rate	1.5 feet	14 years	40 years
Intermediate Rate	1.9 feet	12.5 years	31 years
High Rate	3.2 feet	8 years	17 years

Flood Risks

Finally, Taylor Engineering used 1-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year return period inflow flood hydrographs as the upstream boundary to model potential impacts of the alternatives on flood conditions. For purposes of flood analysis, the downstream boundary was set to a constant elevated stage of 2.0 feet North American Vertical Datum (NAVD)-88 (2006.81). The USACE Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS), developed for the Amite River and Tributaries Amite River Ecosystem Restoration Feasibility Study, computed the inflow hydrographs. Chapter 5 describes the flood impact analysis and provides the results.

Figures 1 and 2 present stage hydrographs for the 100-year flood event for two swamp areas, SE-1 and NE-2. The hydrograph plots compare the stages for the No Action Plan and the With Project Plan. Figure 1 shows that the project increases peak stage in SE-1 by 0.37 foot. Figure 2 indicates that the project does not change the peak stage in storage area NE-2.

Figures 3 and 4 illustrate the project impact on 100-year flood stages at two channel locations, Amite River near Old River and ARDC near Amite River. Figures 3 and 4 show that that the project reduces peak stage at the Amite River near Old River by 0.27 foot, and at ARDC near Amite River by 0.49 foot.

Simulations of the 1-, 2-, 5-, 10-, 25-, 50-, 200-, and 500-year storm events show similar trends in flood impacts: slight increases in stage for the swamp areas and slight decreases in stage for the Amite River and ARDC.

The qualitative nature of these results is consistent with the increased exchange between the ARDC and the swamp for the With Project Plan. Results, however, overstate the magnitude of the With Project impact given the way the model represents the swamp. During a flood event, flow characteristics in overbanks (swamp) change from off-channel storage to conveyance.

The proposed plan features will not restrict flow in the ARDC or in the swamps adjacent to the ARDC. Therefore there would not be an increase in the risk of flooding within the study area. Additionally, increased flood risks would not occur for any nearby businesses and residences as a result of all proposed actions.

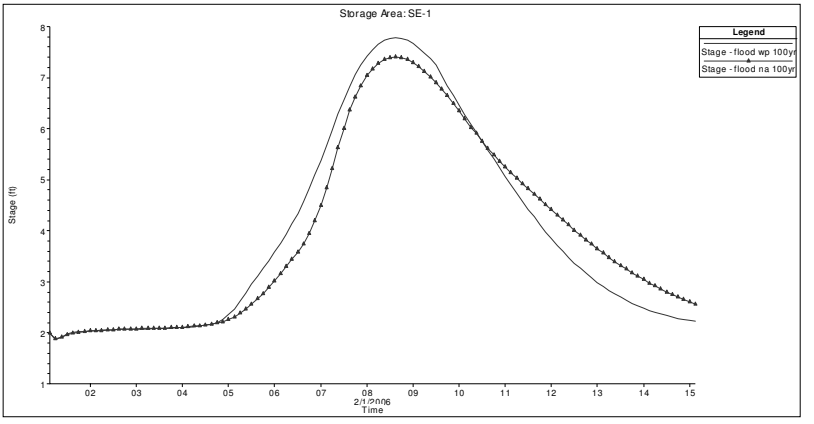


Figure 1 Storage Area SE-1

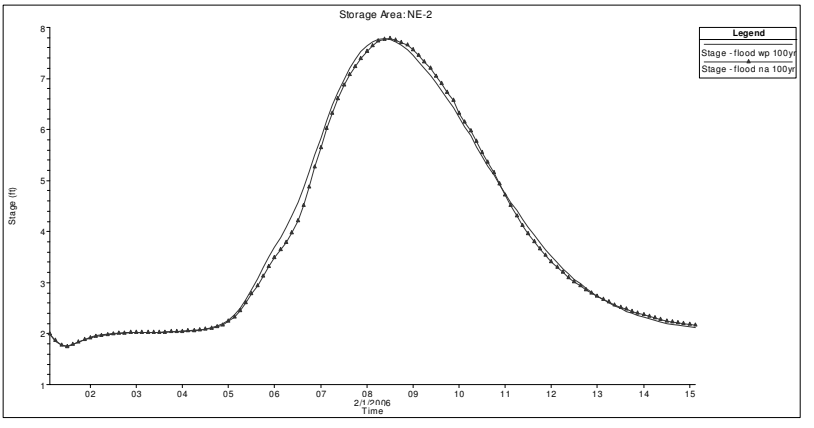


Figure 2 Storage Area NE-2

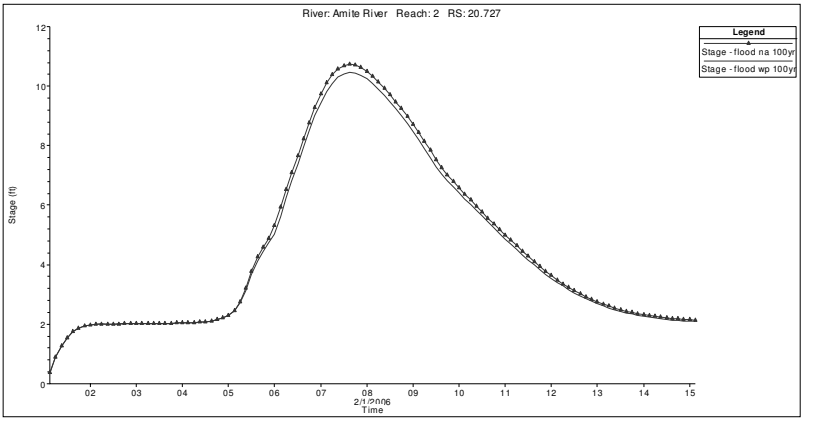


Figure 3 Amite River near Old River

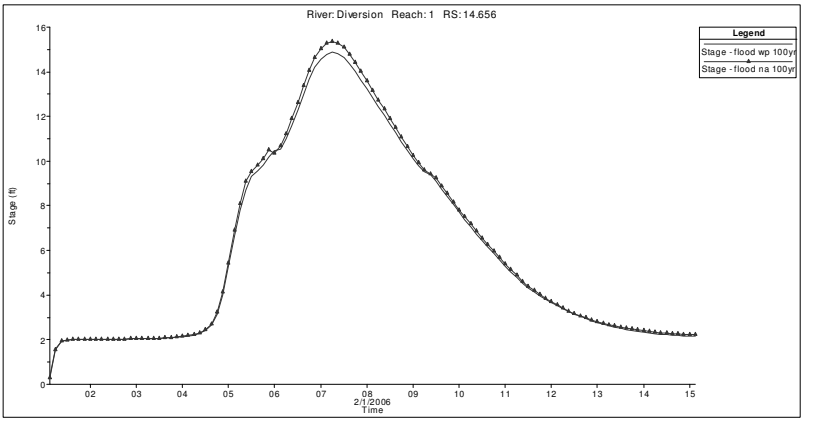


Figure 4 ARDC near Amite River

Conclusions

The results of the analysis show that the proposed new exchange channels can meet the hydrodynamic objectives of the project. The proposed new exchange channels would improve the conveyance of ARDC water into the swamp, and allow a more natural wetting and drying cycle in the swamp. The effect of RSLR would reduce the improvements in swamp dry periods, with eventual permanent inundation.

The proposed exchange channels may cause a minor increase in peak flood stages in the swamps near the ARDC, and a minor decrease in peak flood stages in the Amite River and ARDC. The Amite River Diversion Canal Modification project would not increase the flood risk.

J. Anthony Cavell, P.L.S., C.Fed.S.

August 12, 2009

George W. Hudson, P.E.,
Senior Engineer
Taylor Engineering, Inc.
2133 Silverside Drive, Suite C
Baton Rouge, Louisiana 70808

Dear George:

We have measured and analyzed over 500 points along routes selected by Taylor Engineering. These points were compared to the vertical values for those locations according to the Digital Elevation Model that was based on the Louisiana LiDAR. The topographic information for this survey is referenced to the North American Vertical Datum of 1988 (NAVD88) and the National Geodetic Datum of 1983 (NAD83). Those along the diversion canal were not able to be compared due to acute changes in the topography since the LiDAR was taken, leaving over 300 points to analyze.

The result of our analysis is that the LiDAR based DEM passes at the 0.8 foot level the National Map Accuracy Standards (NMAS) test for agreement with the vertical data based on the LSU GULFNet Reference System. Please see the diagram attached. The mean difference is only 0.01 foot down. I think no adjustment to the LiDAR DEM is suggested by our measurements along the roadways.

This report will follow in hard-copy form accompanied by digital records on CD or DVD media.

If I can be of further service, please don't hesitate to call.

Yours truly,

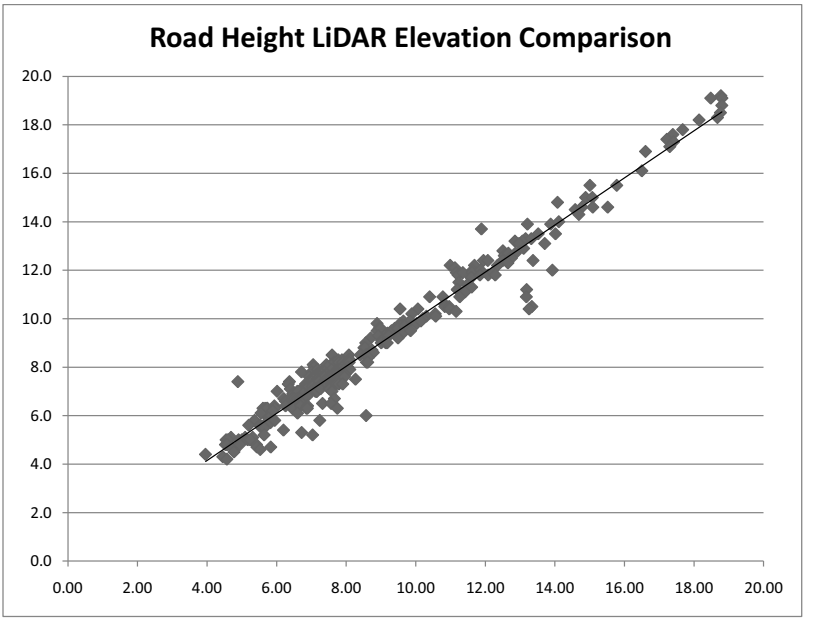
J. Anthony Cavell, P.L.S., C.Fed.S.

Enclosure

11646 Rue Concord – Baton Rouge, LA 70810 – (225) 218-4011

J. Anthony Cavell, P.L.S., C.Fed.S.

August 12, 2009



Count	318
Average	-0.01
Count (.4)	209.00
% <= 0.4	66%
Count (.8)	287.00
% <= 0.8	90%

11646 Rue Concord – Baton Rouge, LA 70810 – (225) 218-4011

Top of Water and Staff measurements

					m	**ft**
Staff	EPA-B				-0.131	-0.43
					m	**ft**
Staff	EPA-RR				-0.287	-0.94
CDT	**Name**	**Northing**	**Easting**	**Elevation**	**m**	**ft**
6:49pm	PV tow	202587.506	1049067.756	0.131	0.131	0.43
7:36pm	H16-tow	196710.137	1054712.238	0.137	0.137	0.45
8:36pm	Clio-tow	200718.155	1069887.085	0.139	0.139	0.46
Wednesday July 15, 2009						

Benchmarks measured or set

Point listing				
Name	Northing	Easting	Elevation	Feature Code
NEWR2.62	190622.470	1049308.163	6.345	mon
ClioTBM	200609.449	1069713.118	11.714	tbm
PV TBM	202595.105	1049025.429	12.827	tbm
H16 TBM	196813.804	1053404.566	15.714	tbm
TBM RR-OS	191629.615	1062314.669	6.555	tbm
TBM SE1-2-OS	191648.860	1061542.706	8.176	tbm
TBMSE1-1	191623.641	1059937.287	7.396	tbm
TBMBridge	191939.941	1056962.321	10.928	tbm

AYLOR ENGINEERING, INC.

Hydrology and Hydraulics Final Report in Support of Louisiana Coastal Area, Amite Diversion Canal Modifications Ecosystem Restoration Feasibility Study

Ascension and Livingston Parishes, LA

January 2010



Hydrology and Hydraulics
Final Report

In Support of
Louisiana Coastal Area
Amite River Diversion Canal Modification
Ecosystem Restoration Feasibility Study

Prepared for

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January 2010

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1.0 INTRODUCTION

The Amite River Diversion Canal Modification Ecosystem Restoration Feasibility Study is being conducted under the federally authorized Louisiana Coastal Area program (Water Resources Development Act, 2007), under a cooperative agreement between the U.S. Army Corps of Engineers (USACE) and the Louisiana Office of Coastal Protection and Restoration (OCPR, formerly Louisiana Department of Natural Resources, Office of Coastal Restoration). OCPR contracted with Taylor Engineering to develop a one-dimensional hydrodynamic model to evaluate existing conditions (No Action Plan) and proposed restoration alternatives (With Project Plan) for the feasibility study (FS). Taylor Engineering worked as part of a Project Delivery Team (PDT) comprised of project managers, scientists, engineers from the OCPR and USACE, local university experts on the Maurepas Swamp, and representatives of the FS lead contractor, GEC, Inc. Taylor Engineering collected field and survey information in support of the analysis with help from Environmental Coastal and Safety Inc. and Anthony Cavell, P.L.S.

The restoration alternatives developed by the PDT consist of proposed openings in the elevated man-made banks of the Amite River Diversion Canal (ARDC). The hydrodynamic model quantifies the exchange between the ARDC and the adjacent bald cypress-tupelo swamp for existing and alternative conditions, together with estimates of anticipated stage duration over a 10-year period. Model results should facilitate further assessment of ecological impacts of alternative plans.

1.1 Study Area

Figure 1.1 (prepared by GEC) shows the limits of the 36 square-mile study area, which lies within the regional western Maurepas Swamp. The study area contains approximately 19,000 acres of subsiding, degraded bald cypress tupelo swamp. In 1963, the USACE constructed the ARDC — a 10.6-mile-long man-made channel — to divert excess flood water from Amite River to Blind River. Blind River discharges into Lake Maurepas approximately 4.8 miles downstream from its confluence with the ARDC. Made from ARDC excavated material at the time of construction, the elevated banks on both sides of the ARDC disrupt the natural hydrologic regime.

The topographic data (based on LIDAR) shows the natural ground elevation in the study area ranges from 1 to 3 feet NAVD-88. [A check of the LIDAR elevation in the study area indicated that for purposes of this study, the LIDAR is compatible with other elevation references to the current vertical datum, NAVD-88 (2006.81).] The natural elevation of the swamp sits just above the mean high water level of Lake Maurepas, 1.0 feet NAVD-88 (2006.81). Some very mild rises, one or two feet above the

swamp floor, are present. The overall study area has a mild topographic slope to the south and southeast. The larger channels, such as the Amite River, Blind River, Old River, Bayou Chene Blanc, and Petite Amite River, have typically created their own, very low natural banks, only about one to three feet above the swamp. Exchange via numerous small, shallow sloughs that penetrate the natural low banks dominates the natural exchange between the larger channels and the swamp.

A major regional river, the Amite River drains the Baton Rouge metropolitan area. Its watershed, which extends northward into southwestern Mississippi, encompasses an area of over 1,800 square miles. Lake Maurepas, a coastal water body enclosing over 90 square miles, connects to the Gulf of Mexico via Pass Manchac and Lake Pontchartrain. Lake Maurepas is subject to coastal astronomical and meteorological tides.

The study area and regional swamps are the product of geologically recent Holocene alluvial deposition. Post-glacial rising sea levels, and associated drowning of the lower Mississippi River valley over the last 10,000 years, have created and reworked the vast coastal deltas and river floodplains of southeast Louisiana. Similar processes, at a much smaller scale, occurred at the mouth of the Amite River. The combination of Mississippi River and Amite River depositional processes formed and sustained the western Maurepas Swamp before human intervention. Modification of regional hydrology over the last two centuries has substantially reduced the natural nourishment of the swamp, prevented mineral sediment introduction, and impaired vegetation productivity and the generation and maintenance of organic substrate. One major aspect of the swamp degradation has been the inability of the ground level to keep pace with the natural subsidence of the fine, poorly consolidated deltaic and alluvial sediments.

The inflow hydrograph from Amite River and stages in Lake Maurepas influence present-day stage, discharge, and the duration of flood and dry conditions in the study area. A recent Amite River flood event occurred with heavy rainfall in the upper watersheds during Tropical Storm Allison in 2001. This river-dominated flood raised swamp water surface elevations (WSE) to over 4 feet NAVD-88. Hurricanes Rita in 2004 and Ike in 2008 both produced high stages in Lake Maurepas on the order of 5 feet NAVD-88. Hurricane Juan in 1985 produced even higher stages in Lake Maurepas. Low stages occur in the Amite River and Lake Maurepas sporadically between the late spring and fall. When low flows in the Amite River basin combine with extended periods of northerly winds, the stage in Lake Maurepas drops and causes substantial drainage of the swamps.

1.2 Overview of Modeling

Taylor Engineering used the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) program to model study area flow and stages. The HEC-RAS unsteady state routine simulates channels and adjacent floodplain swamps as a one-dimensional hydrodynamic system. The model treats the swamp adjacent to the ARDC as a storage area. HEC-RAS uses Modified Plus or level pool routing to simulate a storage area. HEC-RAS does not simulate two-dimensional flow patterns in the swamp. Taylor Engineering used U. S. Geological Survey (USGS) stream gage data for the upstream boundary condition (inflow hydrograph) and for the downstream boundary condition (stage hydrograph). Chapter 2 describes the development of the HEC-RAS model, calibrated with 2005 data from two OCPR swamp gages.

To simulate the No Action Plan and the ARDC modification, Taylor Engineering conducted long-term hydrologic simulations of the study area based on average daily discharge and daily stages for the 10-year period from January 1, 1999 to December 31, 2008. Extracted estimates of flood and drying days established the current or baseline conditions needed to evaluate the proposed alternatives. Chapter 3 describes the HEC-RAS modeling for the No Action Plan and the With Project Plan, which represented seven different alternatives, and presents the results.

Taylor Engineering evaluated the potential hydrologic impact on the No Action Plan and the modification alternatives for estimates of relative sea level rise (RSLR) in accordance with guidance provided by the USACE, New Orleans District. Chapter 4 describes the analysis of RSLR effects on the alternative plans and provides the results.

Finally, Taylor Engineering used 1-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year return period inflow flood hydrographs as the upstream boundary to model potential impacts of the alternatives on flood conditions. For purposes of flood analysis, the downstream boundary was set to a constant elevated stage of 2.0 feet NAVD-88 (2006.81). The USACE Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS), developed for the Amite River and Tributaries Amite River Ecosystem Restoration Feasibility Study, computed the inflow hydrographs.. Chapter 5 describes the flood impact analysis and provides the results.

Chapter 6 presents conclusions from the hydrologic and hydraulic analysis of the ARDC modification alternatives.

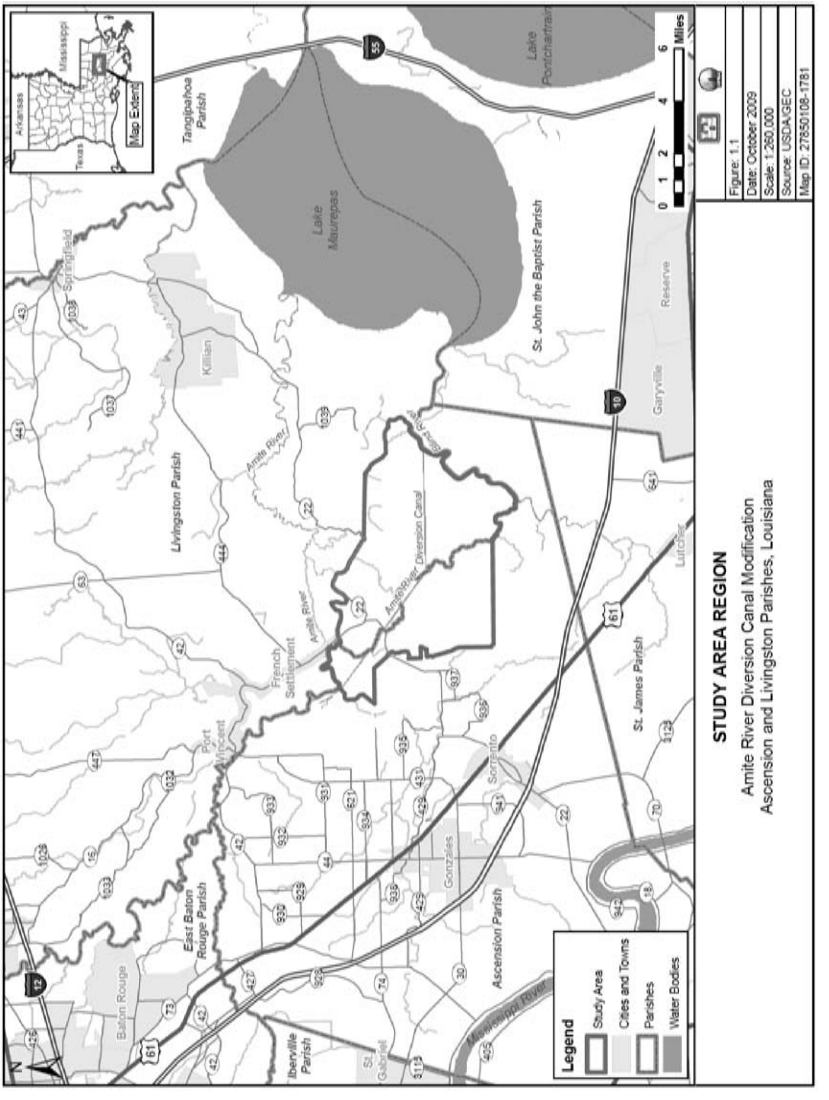


Figure 1.1 Study Area

2.0 HYDROLOGICAL MODEL DEVELOPMENT AND CALIBRATION

2.1 Model Development and Geometry

The HEC-RAS one-dimensional model simulates daily flows and stages in the study area, including the exchange between major channels and the surrounding swamp. A review of the OCPR gage data for 2005 shows the model had to simulate the hydrological conditions from stage as low as -1.0 feet NGVD to a high as 5.0 feet NGVD. In order to simulate these conditions, the model geometry incorporated eight major river reaches and six major swamp storage areas. Streams and storage areas in the HEC-RAS geometry file for the current conditions (calibration model) include

- Amite River, from upstream of the ARDC to Lake Maurepas
- Amite River Diversion Canal, from its confluence with Amite River to Blind River
- Blind River, from the Petite Amite River to Lake Maurepas
- Petite Amite River, from the ARDC to Blind River
- Petite Amite River, north of the ARDC to storage area NW-2
- Old River, from Amite River to Chinquapin Canal
- Chinquapin Canal, from Old River to Bayou Chene Blanc
- Bayou Chene Blanc, from Chinquapin Canal to Blind River
- Storage areas North West 2 (NW-2), North East 1 (NE-1), North East 2 (NE-2) South West 2 (SW-2), South East 1 (SE-1), and South East 2 (SE-2)

Natural ridges, man-made features such as an abandoned railroad embankment and the ARDC banks, and streams that provide a source of water during high stages or high flow provided fixed points to delineate storage areas. Lateral structures, culverts, and connections in the model simulate flow into and out of the storage areas.

Figure 2.1 presents the HEC-RAS geometry file for the calibration model.

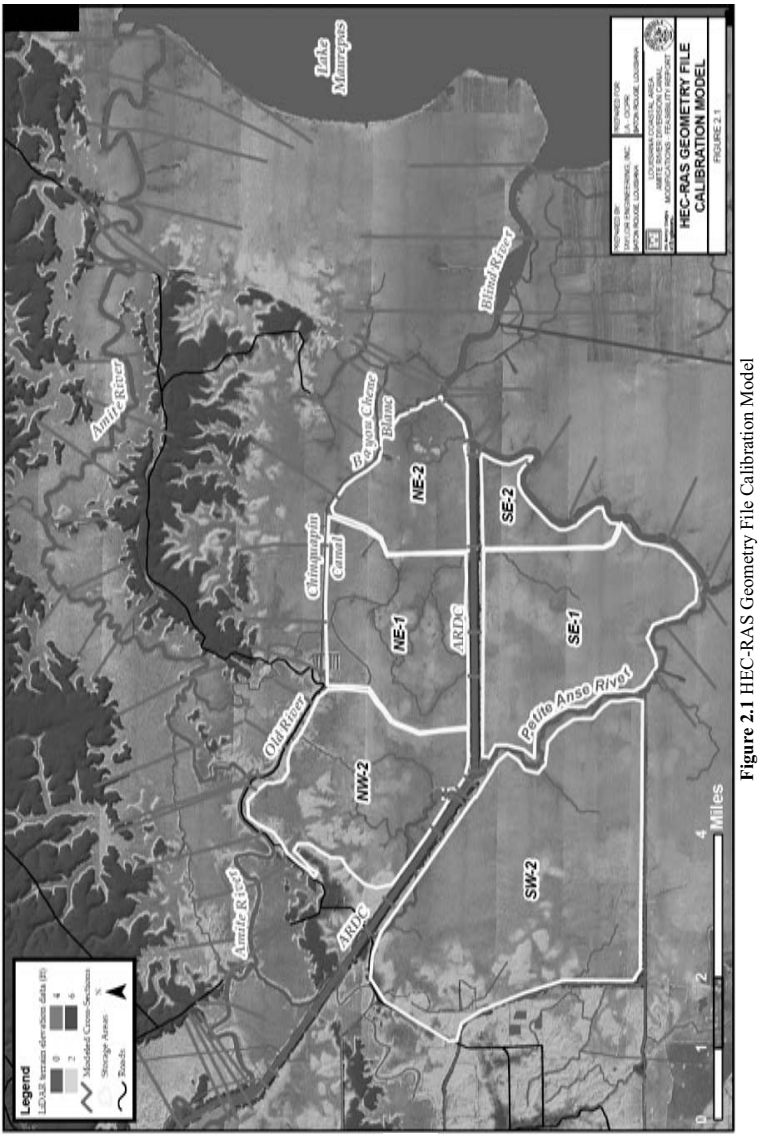


Figure 2.1 HEC-RAS Geometry File Calibration Model

2.2 Key Model Features

Storage areas and hydraulic connections were used to simulate flow and stages in the swamp. HEC-RAS uses Modified Plus or level pool routing to compute stages in a storage area. A one-dimensional model, HEC-RAS does not simulate flow circulation within the swamp.

Generally, the exchange between the study area channels (the ARDC, rivers, bayous, and sloughs) and the swamp remains very slow at low stages and increases significantly at high stages. Banks associated with natural streams and areas of sediment deposition, with elevations ranging from 1.2 to 3 feet, contain the swamp storage areas. For low flow conditions, culverts (and associated equations) maintain continuity of flow and stabilize the unsteady state simulation. For high stage overbank flow conditions between the channels and the swamp, weir features (and associated equations) perform a similar function. Weirs represent high stage conveyance at lateral structures, storage area connections, and road embankments. Model calibration entailed adjusting weir lengths and weir elevations to obtain a best fit when comparing the model output to the observed stage data.

2.3 Model Boundary Conditions

The following mean daily stage data (2005) from two USGS gages provided the upstream and downstream boundary conditions for model calibration.

- Amite River at Port Vincent, Louisiana. The mean daily discharge data for this gage represents the upstream inflow boundary condition.
- Amite River at Highway 22 near Maurepas, Louisiana. The mean daily stage for this gage represents the downstream stage boundary conditions, i.e., the stage in Lake Maurepas.

Taylor Engineering arranged for surveying of the USGS gages and adjusted the stage data to NAVD-88 (2006.81). Table 2.1 lists information for these two regional USGS gage stations, together with a third gage at French Settlement. Figure 2.2 shows the locations of the three USGS gages. Figure 2.3 includes hydrographs for the USGS gages adjusted to NAVD-88 (2006.81).

Table 2.1 List of USGS Gages

Station No.	Station Name	Data	Dates	Peak Stage*
7380120	Amite River at Port Vincent	Flow and stage	10/1984 to present	12.73 ft NGVD-29, June 11, 2001; 14.65 ft NGVD-29, April 9, 1983 obtained from observation
07380200	Amite River near French Settlement	Stage	1950 – 1992 1996 to present	7.40 ft NGVD-29, April 29, 1977
07380215	Amite River at Hwy 22 near Maurepas	Stage	1998 to present	5.40 ft NAVD-88, August 13, 2008

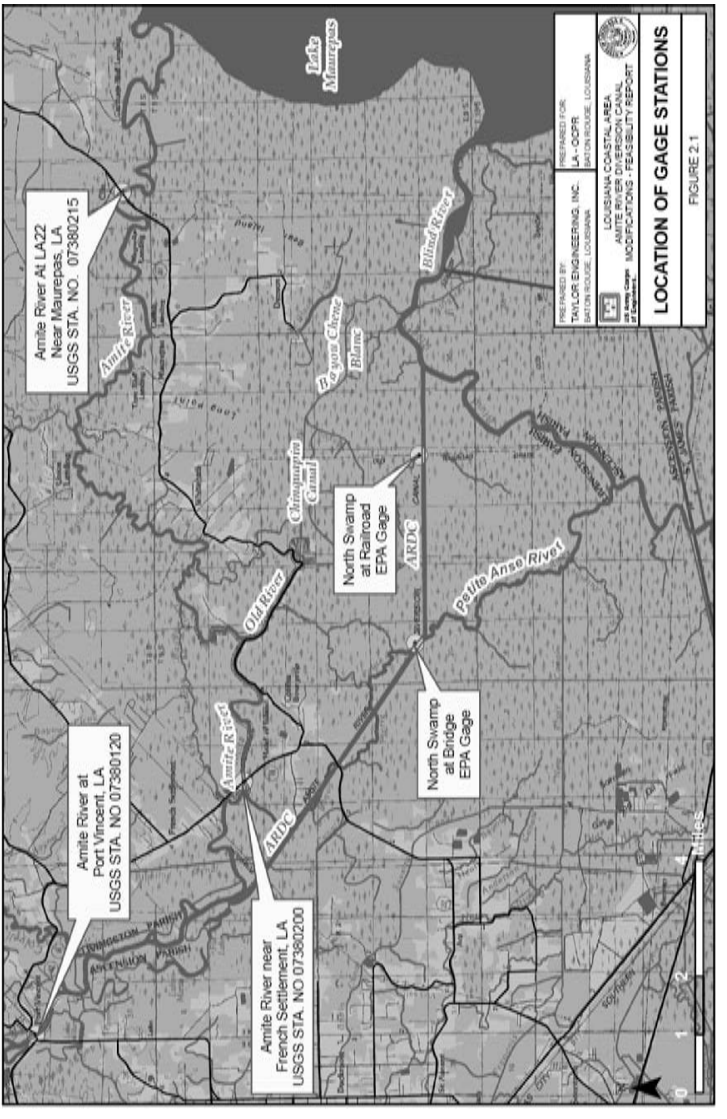


Figure 2.2 Location of Gage Stations

2.4 Model Calibration Data

Taylor Engineering used data from two swamp gages installed and operated by OCPR in 2005, to calibrate model parameters. The gage labeled “North Swamp at Bridge” — located near the bridge over the Petite Amite River, north of the ARDC — represents a swamp area with good hydraulic connection to the ARDC. The gage labeled “North Swamp at Railroad” — located near an abandon railroad embankment, north of the ARDC — represents an area with no connection to the ARDC. Figure 2.2 (above) shows the locations of the OCPR gages North Swamp at Bridge and North Swamp at Railroad.

At the time of installation, OCPR and USEPA placed staff gages at each station with the continuous recording gages referenced to the zero level on the staff gage. Taylor Engineering inspected the gage locations in 2009, including staff gages at the North Swamp at Bridge and North Swamp at Railroad, and arranged for surveying the two swamp staff gages in order to adjust the stage records to NAVD-88 (2006.81). OCPR provided the continuous stage data for the gages from January 21, 2005 through December 1, 2005 and Taylor Engineering corrected the data to NAVD-88 (2006.81). Figure 2.3 includes the 2005 stage data for the two OCPR swamp gages, adjusted to NAVD-88 (2006.81).

The Amite River gages show low stages for several weeks during a dry period in May 2005. Both OCPR swamp gages — North Swamp at Railroad and North Swamp at Bridge — show stages below the typical natural ground elevations, 1.0 to 1.2 feet NAVD-88 (2006.81), during the period. The gages allowed for water level measurements below the local ground surface. The swamp gages show that surface water levels for this period reflect substantial draining of free standing water from the swamp and the influence of shallow groundwater elevations.

Taylor Engineering used the mean daily stage for the third regional USGS gage, Amite River near French Settlement, as part of an overall evaluation of model performance.

2.5 Calibration Results

From the above model geometry and boundary conditions, the HEC-RAS model simulated the January 21, 2005 through December 1, 2005 period. HEC-RAS computed flows and stages at each cross section and for each storage areas. Figures 2.4 and 2.5 present comparisons of the observed and computed stages for North Swamp at Bridge and the North Swamp at Railroad. Calibration results show the following:

- The model cannot simulate below grade (groundwater) swamp WSE in May 2005.
- The model produces slightly higher average (0.12 foot) WSE for the North Swamp at Bridge than the observed data.
- The model produces slightly higher average (0.01 foot) WSE for the North Swamp at Railroad than the observed data.

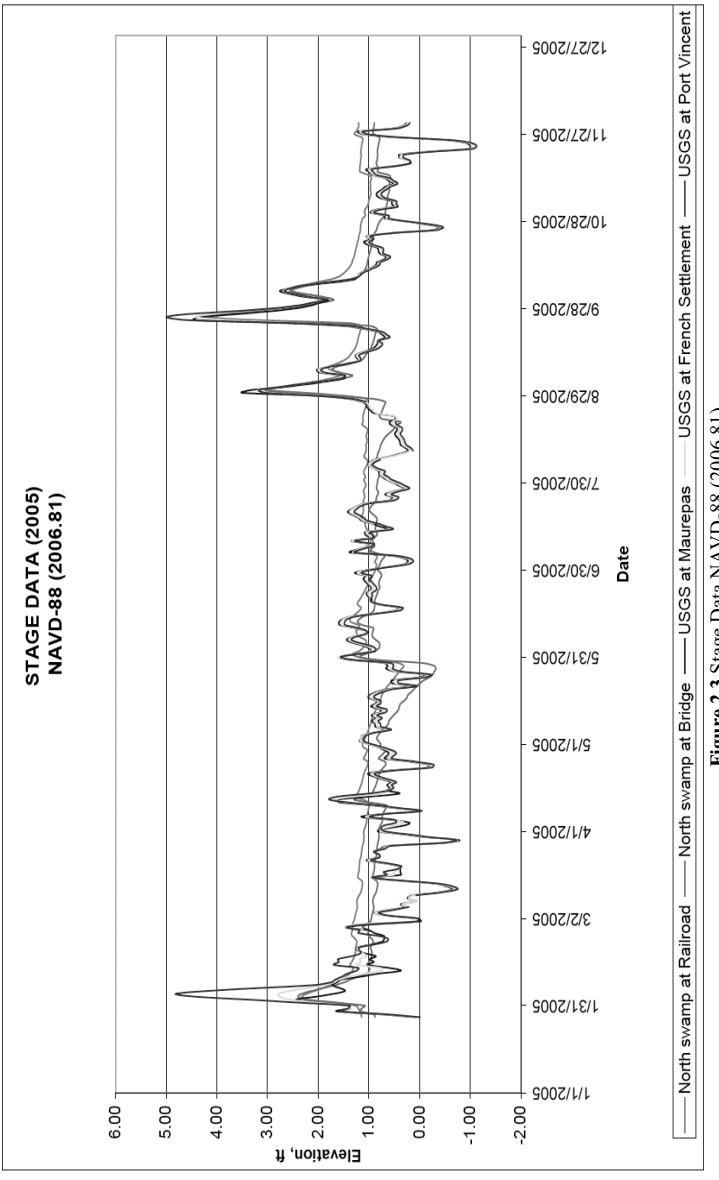


Figure 2.3 Stage Data NAVD-88 (2006.81)

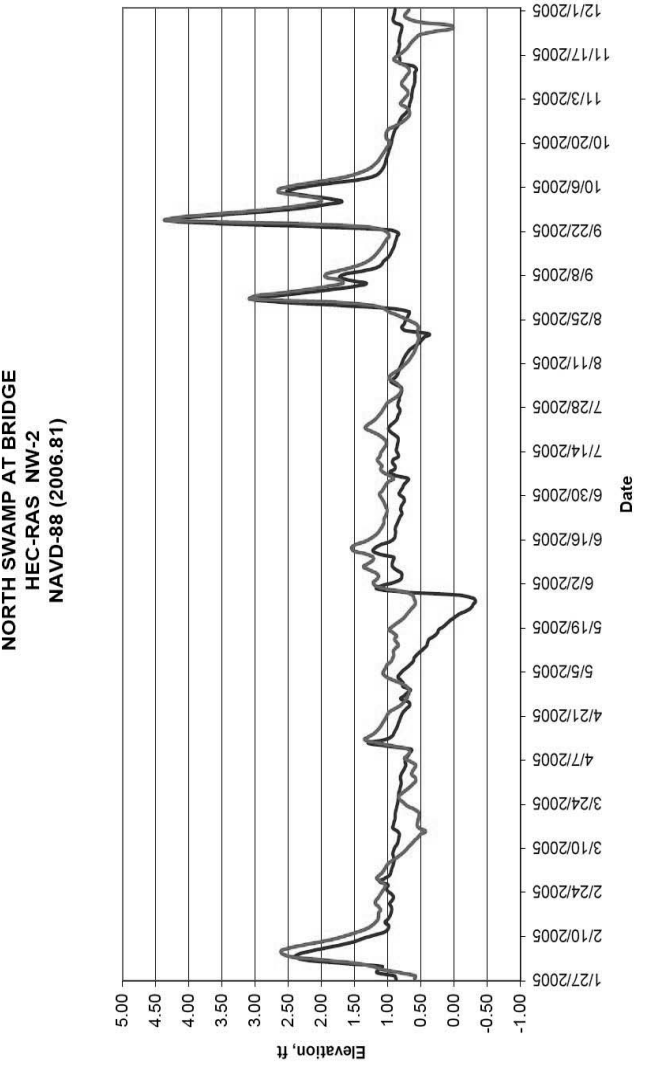


Figure 2.4 HEC-RAS Model and North Swamp at Bridge

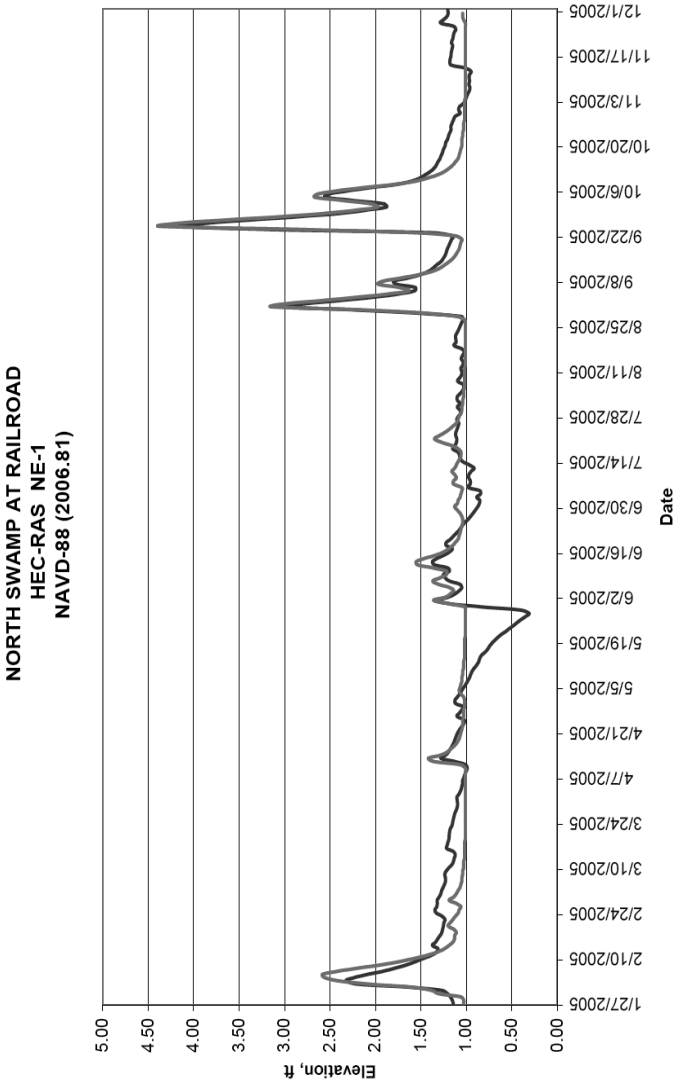


Figure 2.5 HEC-RAS Model and North Swamp at Railroad

3.0 SIMULATION OF ALTERNATIVE PLANS

3.1 General

The PDT developed conceptual alternatives to restore the hydrologic exchange between the ARDC and adjacent swamp in accordance with the federal authorization for the project and previous preliminary reconnaissance-level studies (GEC, 2008) The basic objective of the alternatives is to improve the hydraulic connection between the ARDC and the surrounding swamp, and thereby improve the swamp habit. The improved hydraulic connection should enhance inflow from the ARDC into the swamp and associated enrichment of swamp nutrients and sediments. The improved connection should also facilitate swamp drainage during periods of low flow and stages on the ARDC and Lake Maurepas, and thereby extend dry periods necessary for vegetation productivity.

3.2 Conceptual Design of Alternatives

The PDT conducted field investigations, held meetings, and discussed the nature and functioning of existing sloughs that control the present hydraulic exchange between major channels and the swamp. The characteristics of the existing sloughs provide a reasonable guide for the hydraulic design of new, self-sustaining channels. The proposed exchange channels should ideally mimic natural slough conveyance and the discharge from the swamps during periods of low flow and low stages.

Several natural sloughs surveyed during the field investigation provide the geometry of typical self-sustaining exchange channels, including the cross-sectional area (width and depth of opening) and length into the swamp. A comparison of the bathymetry of these natural sloughs with the size of the swamp area they appeared to drain — based on LIDAR data — helped to develop the following template for the proposed exchange channels:

- Beginning at the ARDC, a 20-foot bottom width opening
- Invert elevation of -5 feet NAVD-88 (2006.81)
- Top width of approximately 70 feet
- 3 horizontal to 1 vertical side slopes throughout
- Length from ARDC up into swamp of several thousand feet
- Tapering to a cross section with a 10-foot bottom width at the upper end of the channel
- Minimum invert elevation of -1 foot NAVD-88 (2006.81) in the upper channel
- Minimum top width of approximately 30 feet in the upper channel

Figure 3.1 illustrates the design for a proposed new exchange channel.

The PDT identified five locations for the new exchange channels based on degraded swamp areas that are converting to marsh, as well as other design constraints such as the existing residential development near the ARDC. Located within two storage areas, SE-1 and NE-2, the five proposed exchange channels include SE-1-1, SE-1-2, NE-2-1, NE-2-2, and NE-2-3.

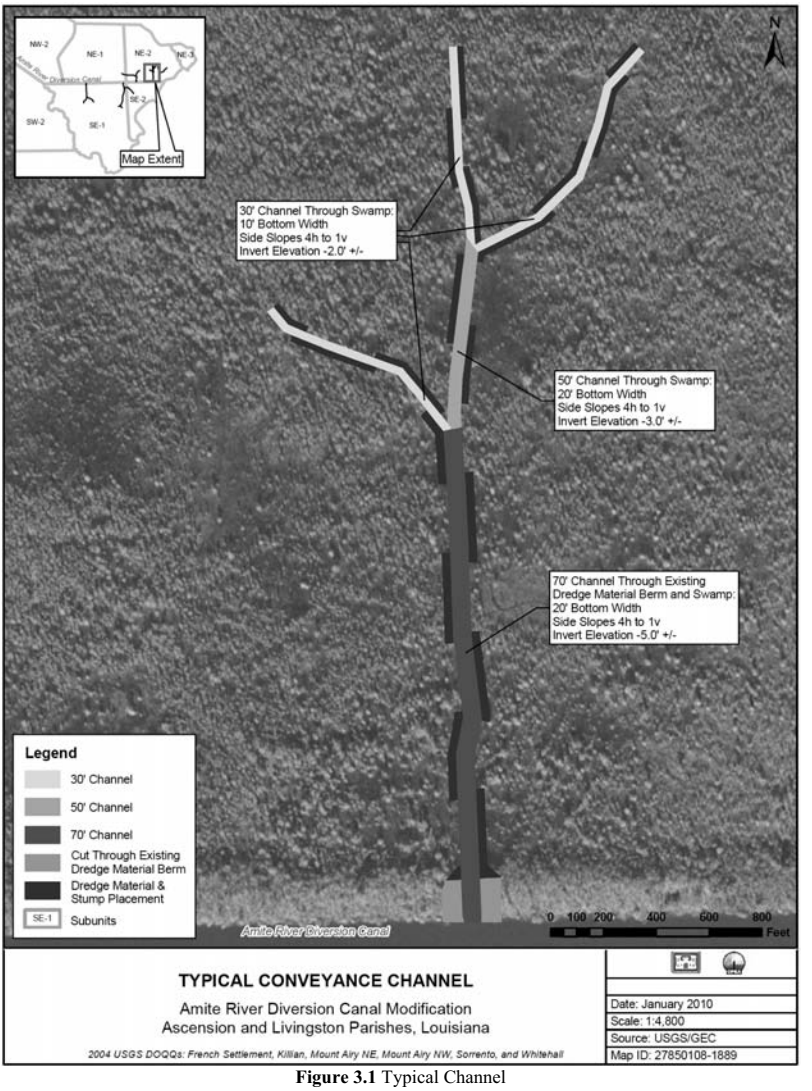


Figure 3.1 Typical Channel

The PDT then developed the seven alternatives in the list below. Each alternative represents selected combinations of the five channel locations and the benefit areas. Figures 3.2 through 3.8 (prepared by GEC) present the plan features and show the locations of the proposed exchange channels.

- Alternative 33: on the north side of the ARDC, three exchange channels (NE-2-1, NE-2-2, and NE-2-3) extending into storage area NE-2
- Alternative 34: on the south side of the ARDC, a single exchange channel (SE-1-2) extending into storage area SE-1
- Alternative 35: on the south side of the ARDC and west of Alternative 34, a single exchange channel (SE-1-1) extending into storage area SE-1
- Alternative 36: four exchange channels that combine Alternative 33 and Alternative 34
- Alternative 37: two exchange channels that combine Alternative 34 and Alternative 35
- Alternative 38: four proposed exchange channels that combine Alternative 33 and Alternative 35
- Alternative 39: five exchange channels that combine Alternative 33 and Alternative 37

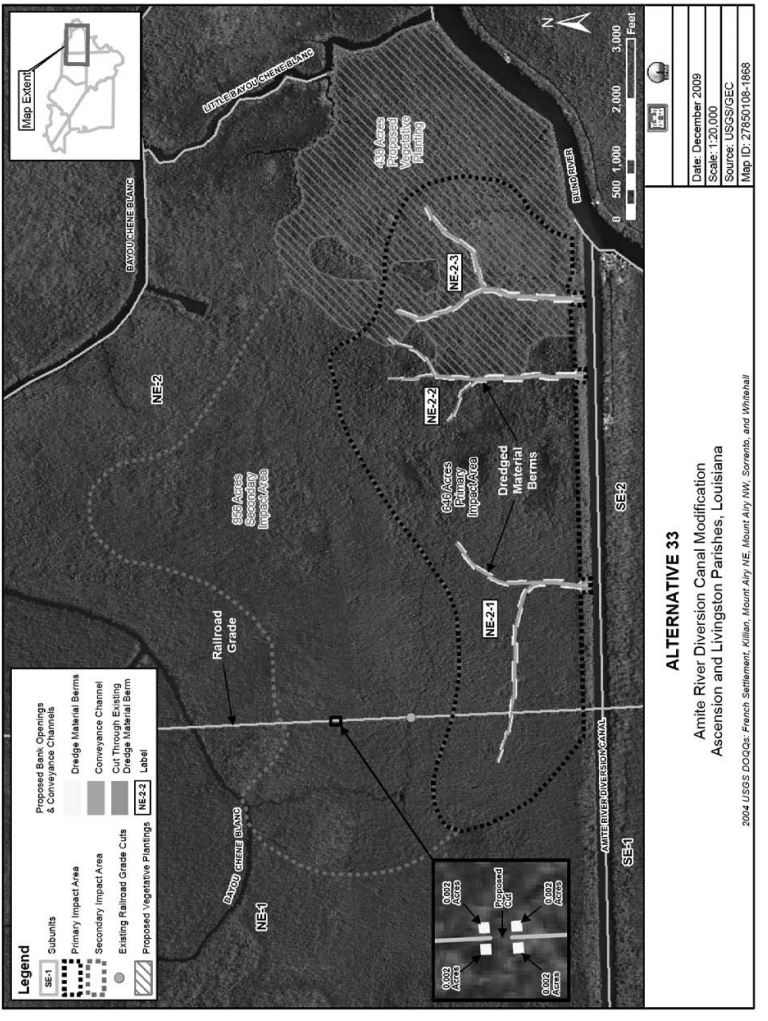


Figure 3.2 Alternative 33

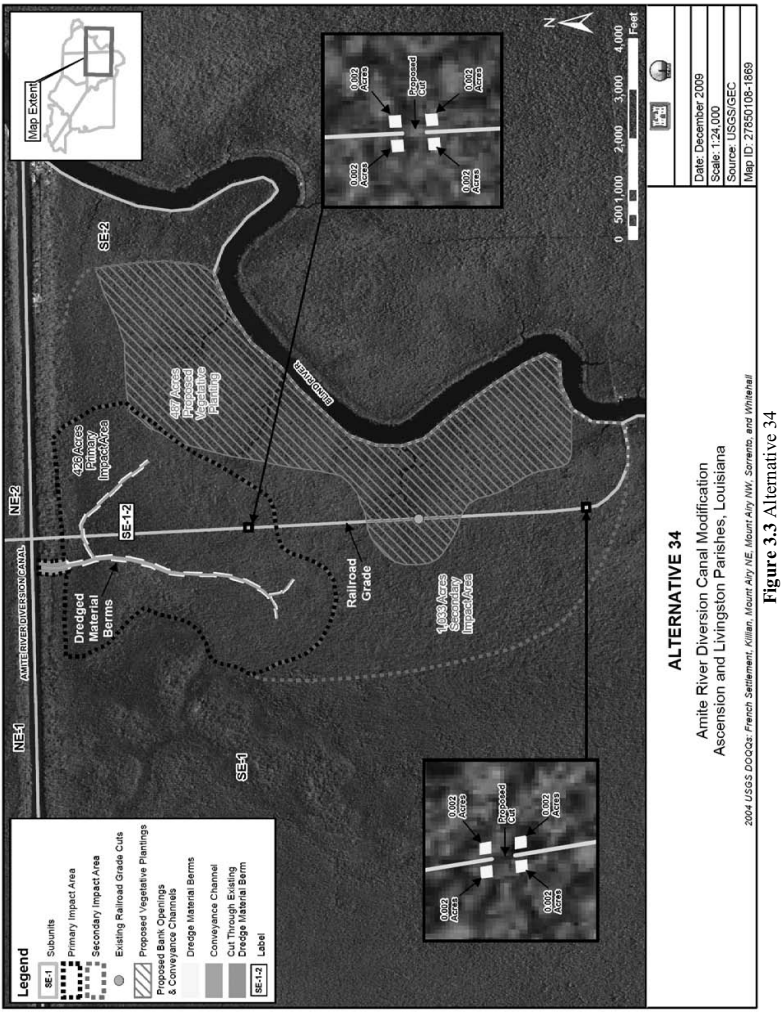


Figure 3.3 Alternative 34

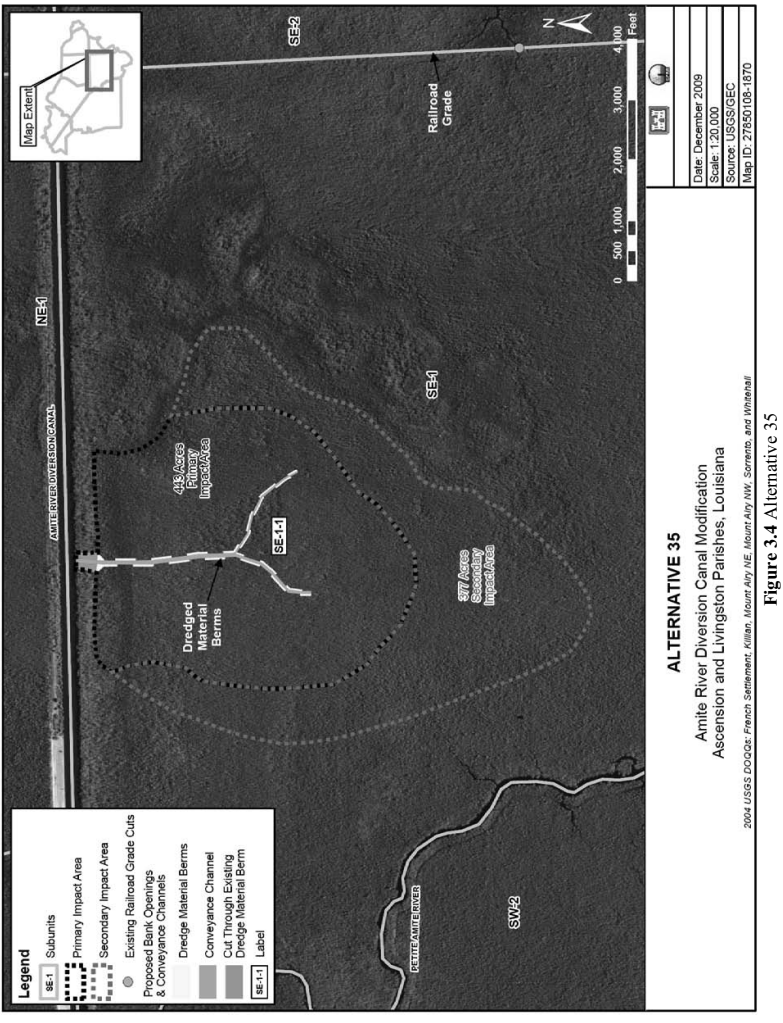


Figure 3.4 Alternative 35

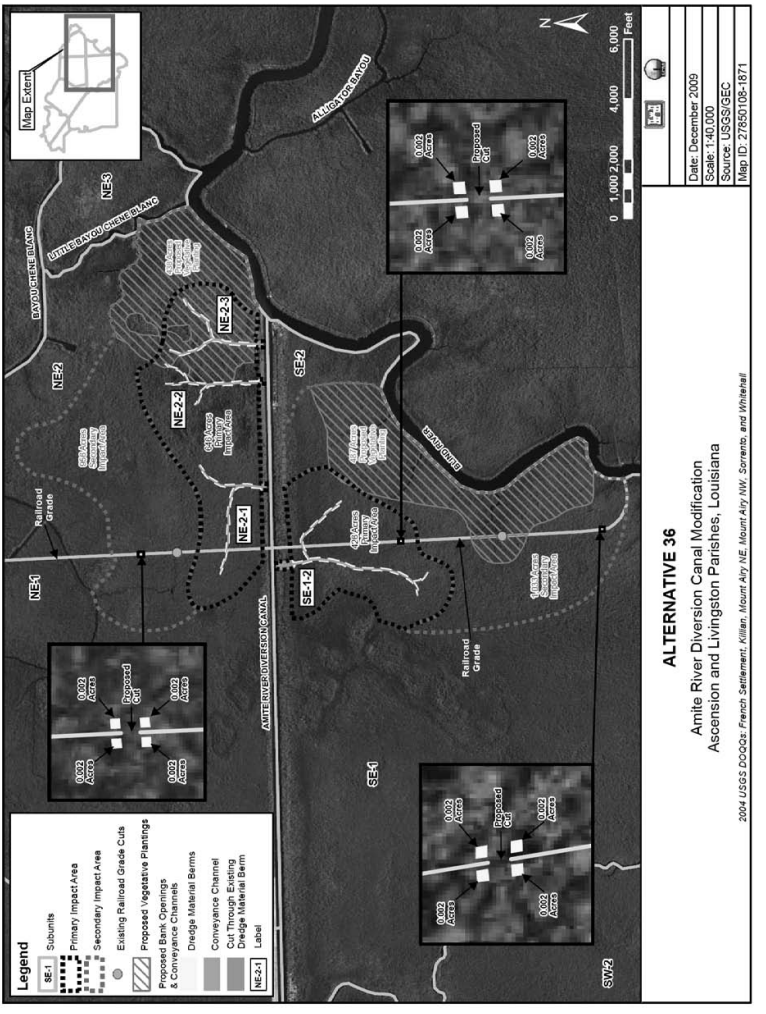


Figure 3.5 Alternative 36

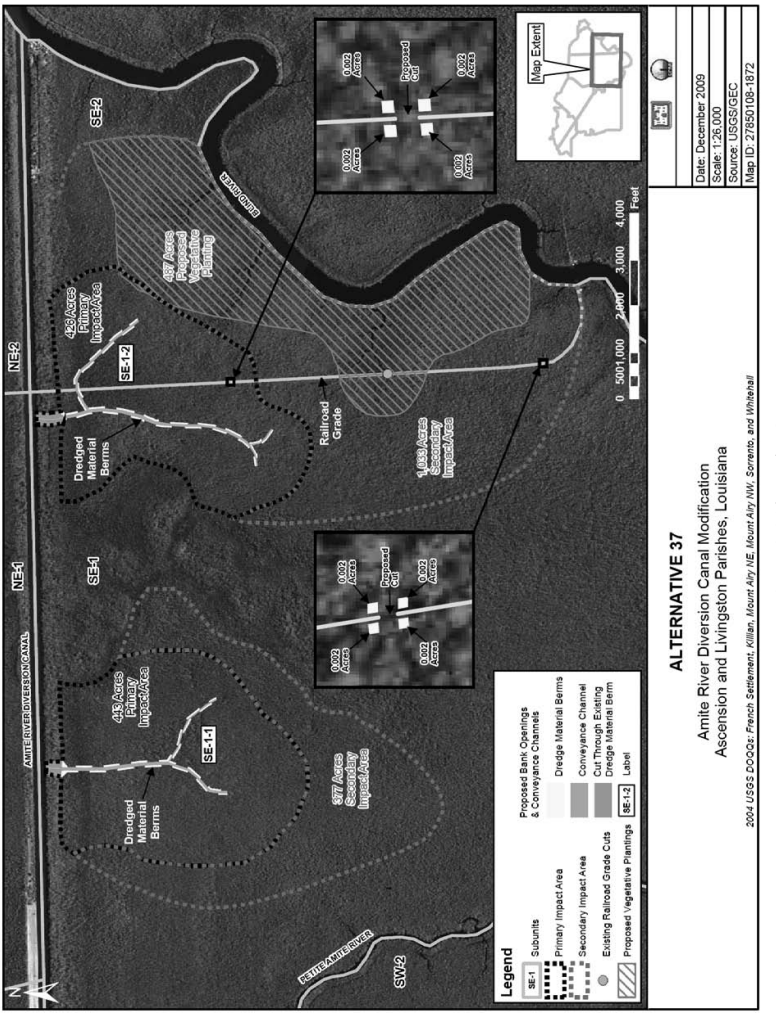


Figure 3.6 Alternative 37

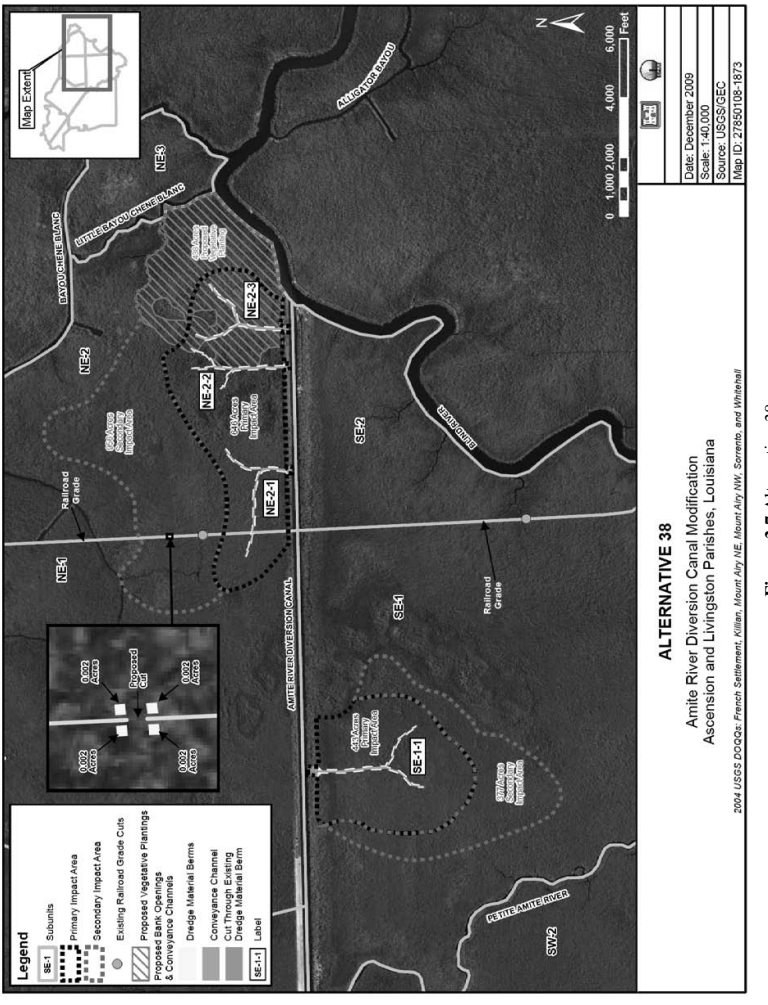


Figure 3.7 Alternative 38

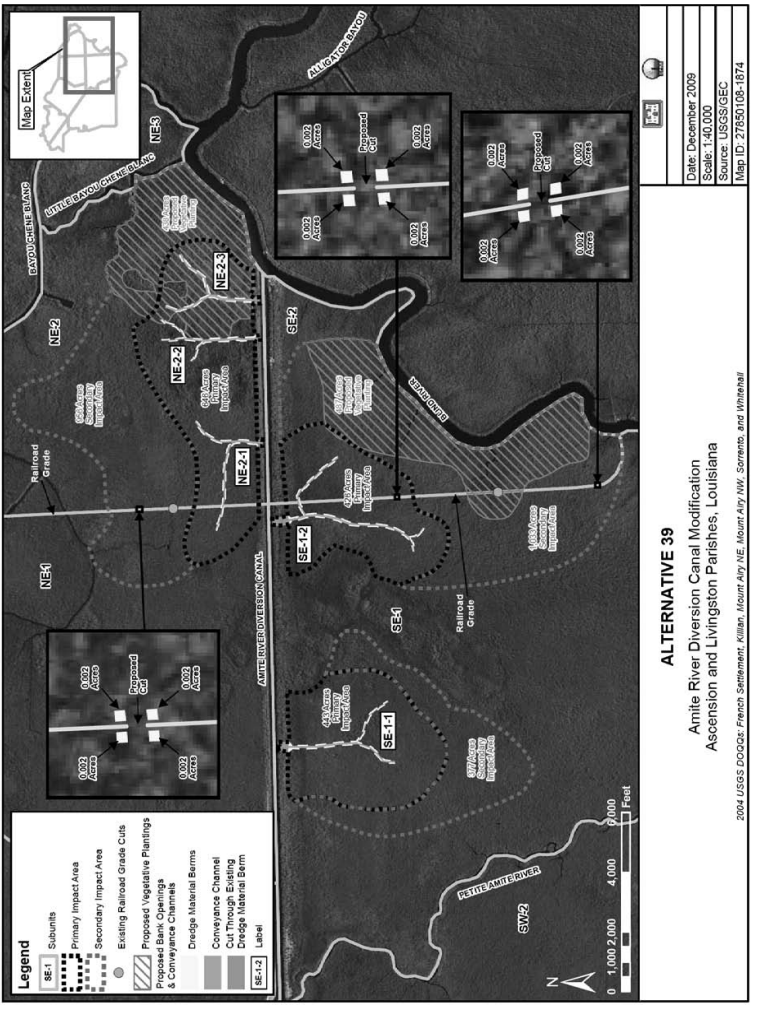


Figure 3.8 Alternative 39

3.3 Geometry File Development

Taylor Engineering developed HEC-RAS geometry files for the No Action Plan and With Project Plan. The geometry of the No Action Plan reflects the existing channels and storage area conditions, as represented in the previously described geometry for the calibration model. The model of the No Action Plan provides base-line conditions for comparison to the alternative plans.

Several factors contributed to the creation of the With Plan geometry file. First, the flow volume and the flow rate through each of the five individual exchange channels is insignificant compared to the total volume, discharge, and the stage in the ARDC. Second, the hydraulic performance of each proposed exchange channel is independent of the others. As such, the With Project geometry file includes all five exchange channels used to analyze the seven alternatives. In the single With Project geometry file, Taylor Engineering slightly increased the size of storage areas NE-2 and SE-1, and correspondingly decreased the size of storage areas NE-1 and SE-2, to capture some of the impact of the proposed degradation of the railroad embankments. Figure 3.9 illustrates the With Project Plan geometry file.

The HEC-RAS geometry file for the With Project Plan represents each proposed exchange channel from the intersection of the ARDC; each exchange channel extends into the swamp for several hundred feet, with cross-sectional dimensions as described above. As with the existing conditions (No Action Plan) model, a road embankment and a culvert crossing the exchange channel represent flow control between the ARDC and the swamp storage area in the new exchange channels. The road embankment and culvert allow simulation of the exchange of flow between the channel and the swamp under both high flow (overbank flow) and low flow (normal conditions).

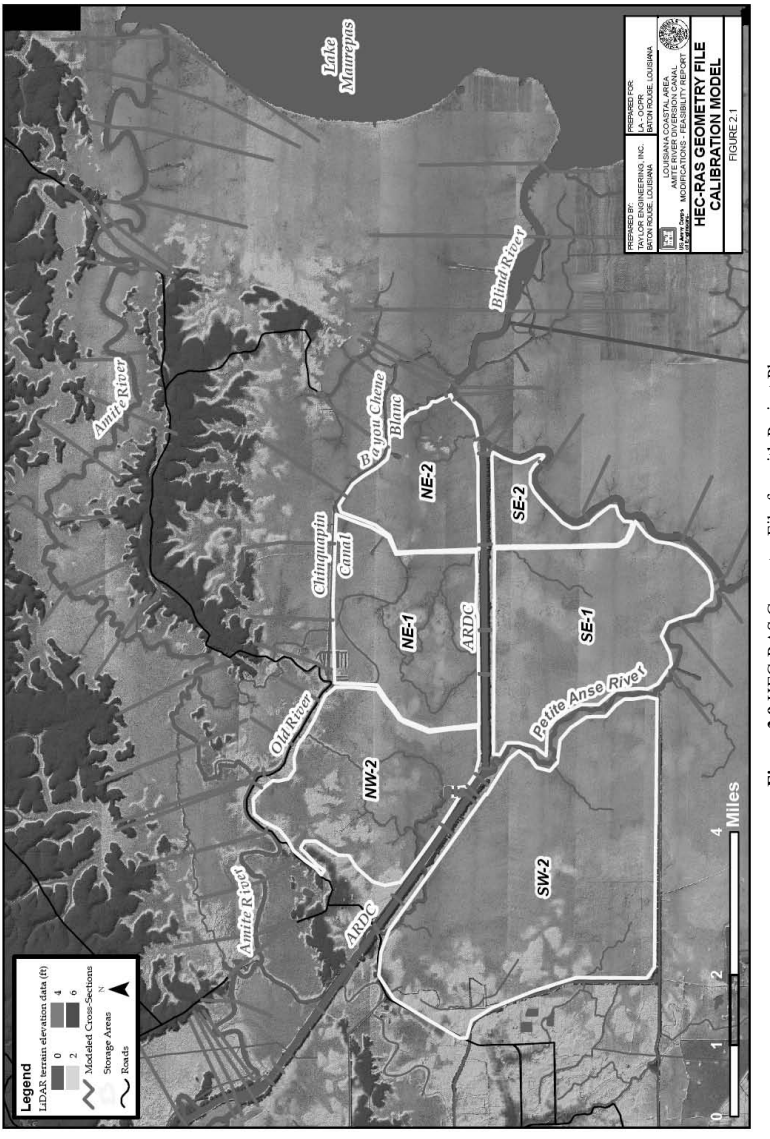


Figure 3.9 HEC-RAS Geometry File for with Project Plan

3.4 Model Boundary Conditions

The hydrological analysis of the No Action Plan and the With Project Plan must consider the possible effects of three other federal projects authorized for construction within the Amite River and the Blind River Watersheds. These three projects include two feasibility studies — the LCA Small Diversion at Convent/Blind River and the LCA Small Diversion at Hope Canal — and a flood risk reduction project — the Amite River and Tributaries (AR&T), Comite River Diversion Canal — currently under construction.

Given the control exerted by the Amite River and Lake Maurepas on study area water levels, the selection of any particular model boundary condition greatly influences the model results. Therefore, Taylor Engineering recommended evaluating the No Action Plan and the restoration alternatives by simulating conditions over a very long timeframe, and assessing the impact to episodic flood and dry conditions in the swamp storage areas. Based on data availability for the upstream (Amite River at Port Vincent) and downstream (Amite River at Maurepas) boundary conditions, Taylor Engineering selected the historical 10-year period of January 1, 1999 to December 31, 2008.

Upstream boundary conditions incorporate the inflow hydrographs from the Blind River Diversion Project and the Hope Canal Diversion Project. The combined inflow hydrographs for the Blind River and the Hope Canal diversions were input into the HEC-RAS model at the confluence of Petite Amite River and Blind River. The LCA Small Diversion at Convent/Blind River and the LCA Small Diversion at Hope Canal projects are currently a feasibility study and the hydraulic design and operating plans have not been determined. The USACE, New Orleans District provided hydraulic design information concerning the design flows and the operating plans. The following summarizes the hydraulic design for the Blind River Diversion and the Hope Canal Diversion projects:

<u>LCA Small Diversion at Convent/Blind River</u>

- Design discharge (January through May) – 1000 to 2500 cubic feet per second (cfs) with 1500 cfs estimated as a good planning discharge rate
- Design discharge (June through November) – 500 cfs
- Diversion flows pulsed 15 days with and 15 days without flow

<u>LCA Small Diversion at Hope Canal</u>

- Design discharge (January through May) – 2000 cfs
- Design discharge (June through November) – 500 to 1500 cfs

- Diversion flows pulsed 10 days with and 20 days without flow
- Approximately 50% of the flow diverted to Blind River

The combined inflow hydrograph for the diversion flows from the Blind River and the Hope Canal diversion projects totals 3,000 cfs (January through May) and 1,500 cfs (June through November).

Taylor Engineering also incorporated the Comite River Diversion Canal project in the Amite River inflow boundary. The Comite River Diversion Canal is designed to divert approximately 50% of the Comite River flow during a flood event. (The Comite River enters the Amite River in Denham Springs, Louisiana, well above the study area.) During low flow periods (flows less than approximately 1,200 cfs), no flow is diverted out of the Comite River. Results from the existing HEC-HMS and HEC-RAS models for the Amite River basin indicate that the Comite River Diversion Canal will reduce flow on the Amite River by approximately 7% during flood events. Taylor Engineering therefore adjusted the Amite River at Port Vincent boundary inflow downward by 7% for flood events.

3.5 Model Results

Tables 3.1 present model results for the No Action Plan and the With Project Plan. Table 3.1a presents a summary of the computed flows in the exchange channels. Table 3.1b and 3.1c present a comparison of stage duration (in days) in swamp storage areas SE-1 and NE-2. Table 3.1b combines results for the two exchange channels in this area. Table 3.1b shows that the With Project Plan increases the percentage of days in SE-1 with WSE at or below 1.0 foot from 6 to 37%. Table 3.1c shows the With Project Plan increases the number of days with WSE at or below 1.0 foot from 7 to 48% in NE-2.

Table 3.1a Computed Flow

With Project (no flow in the No Action Plan)					
Exchange Channel	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6330	5298	4812	4368	4035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6874	7160	3392	3696	4088
% time of outflow	77%	78%	71%	72%	72%

Table 3.1b Stage Duration, Storage Area SE-1

No Action						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	213	2283	2742	2935	3059	3151
% time at or below WSE	6%	62%	75%	80%	84%	86%
Consecutive Days at or below WSE	73	120	138	164	203	204
With Project						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	1352	2390	2770	2950	3070	3160
% time at or below WSE	37%	65%	76%	81%	84%	86%
Consecutive Days at or below WSE	114	121	152	164	203	205

Table 3.1c Stage Duration, Storage Area NE-2

No Action						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	241	2306	2834	3027	3144	3233
% time at or below WSE	7%	63%	78%	83%	86%	88%
Consecutive Days at or below WSE	64	148	184	203	204	205
With Project						
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654
Total days at or below WSE	1750	2501	2865	3032	3153	3236
% time at or below WSE	48%	68%	78%	83%	86%	89%
Consecutive Days at or below WSE	117	150	185	204	204	205

4.0 RELATIVE SEA LEVEL RISE

4.1 General

Given the hydrologic influence of tidal Lake Maurepas and the regional subsidence conditions, relative sea level rise (RSLR) could affect the computed flows in the proposed exchange channels and the stage durations shown in Tables 3.1. In response to this concern, the PDT evaluated the potential impact of RSLR on the restoration alternative. The evaluation adhered to guidelines established in Incorporating Sea Level Change Considerations in Civil Works Programs, EC 1165-2-211, (USACE, 2009a).

4.2 Estimates of RSLR

The USACE guidance requires an assessment of project performance based on three estimates (low, intermediate, and high) of sea level rise. The low estimate reflects the local historic rate for the study area, based on long-term local gage data. The intermediate and high estimates reflect a combination of the local historic subsidence rate with either the modified NRC Curve I or the NRC Curve III estimate of eustatic sea level rise.

The USACE, New Orleans District prepared RSLR estimates in accordance with EC 1165-2-211 for LCA projects Amite River Diversion Canal and Convent/Blind River Diversion (USACE, 2009b). These estimates of RSLR account for both the eustatic rate of sea level rise and the local subsidence rate. The following paragraphs summarize the USACE's documentation of those estimates.

4.2.1 Low Rate

The USACE used the USACE gage at West End at Lake Pontchartrain to calculate a representative historic rate for the project area. Daily stage data from 1959 to 2009 indicate a rate of 9.20 mm/yr (0.0302 ft/yr; see Figure 4.1) with a standard error of the linear trend line of 0.65 foot.

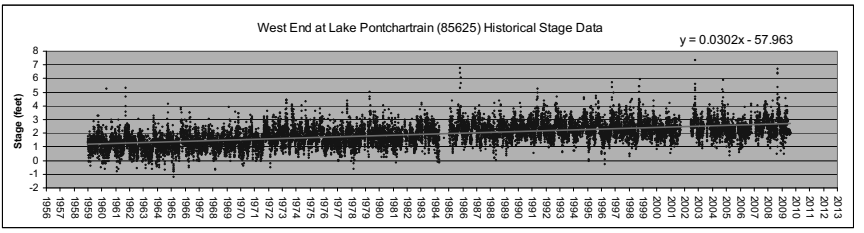


Figure 4.1 Plot of Historic Rate from Daily Stage Data

Using the rate of 9.20 mm/yr, a starting year of 2012, and a 50-year project life, the USACE projects a sea-level rise of 1.5 feet for 2062. The rate of 9.20 mm/yr includes both the eustatic seal level rise and the local subsidence contributions to the estimated total RSLR.

4.2.2 Intermediate and High Rates

To estimate the local subsidence rate for the project area, the USACE subtracted the global eustatic rate (1.7 mm/yr) from the local sea level rate or

Local subsidence rate = 9.20 mm/yr – 1.7 mm/yr = 7.50 mm/yr.

The following formula yields an estimate of the total rise in eustatic sea level for the project life for the intermediate and high rate cases of sea level rise:

$$E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)$$

where:

b = the acceleration factor for each curves, or 2.36E-5 and 1.005E-4, respectively,

t_1 = the time in years between the project's construction date and 1986, and

t_2 = the time between a future date at which one wants an estimate for sea-level rise and 1986.

These eustatic estimates, when added to the local subsidence estimate, yield the total sea-level rise for the intermediate and high rate cases.

Table 4.1 presents a summary of the estimated total sea-level rise in five-year increments through the project life of 50-years for each case. Figure 4.2 shows the estimated sea-level rise for each case.

Table 4.1 Summary of Five-year Sea Level Rise for Each Case (USACE, 2009, Estimated Sea Level Rise for Amite River Diversion and Convent/Blind River Diversion LCA Projects)

Project year	Low Rate (feet)	Intermediate Rate (feet)	High Rate (feet)
2012	0.0	0.0	0.0
2017	0.2	0.2	0.2
2022	0.3	0.3	0.5
2027	0.5	0.5	0.8
2032	0.6	0.7	1.1
2037	0.8	0.9	1.4
2042	0.9	1.1	1.7
2047	1.1	1.3	2.0
2052	1.2	1.5	2.4
2057	1.4	1.7	2.8
2062	1.5	1.9	3.2

4.3 Impact of RSLR

Taylor Engineering reran the HEC-RAS models for the No Action Plan and the With Project Plan for 2062 (Year-50) for the three RLSR cases by adding 1.5, 1.9, and 3.2 feet to the Amite River at Maurepas hydrograph downstream boundary condition. Tables 4.2, 4.3, and 4.4 presents model results. Table 4.2 includes the previous results (Year 1) for computed flows in the exchange channels versus computed Year 50 flows for low, intermediate, and high RSLR. Tables 4.3 and 4.4 provide similar comparisons of stage durations for the previously computed Year 1 versus Year 50 low, intermediate, and high RSLR for the No Action Plan and With Project Plan in SE-1 and NE-2, respectively.

Table 4.2 demonstrates that as stages increase in Lake Maurepas due to RSLR, the flow in the proposed new exchange channels increase.

Tables 4.3 and 4.4 show that RSLR will dramatically reduce the stage duration below 1.0 foot with both the No Action Plan and the With Project Plan. The percentage of days with WSE below 1.0 foot in the SE-1 and NE-2 areas falls from 37 and 48%, respectively, to zero under all three RSLR cases.

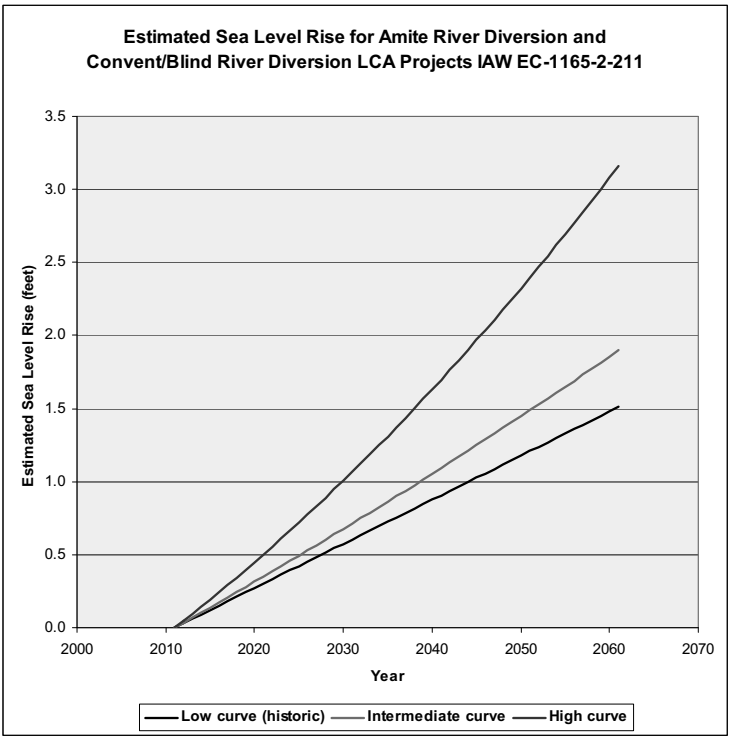


Figure 4.2 Plot of Sea Level Rise for Each Case (USACE, 2009, Estimated Sea Level Rise for Amite River Diversion and Convent/Blind River Diversion LCA Projects)

Table 4.2 Computed Exchange Channel Flows with RSLR

With project with no RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	6330	5298	4812	4368	4035
% time of inflow	23%	22%	29%	28%	28%
Volume outflow (ac-ft/yr)	6874	7160	3392	3696	4088
% time of outflow	77%	78%	71%	72%	72%
With Project with 50 years of Low rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	23175	20734	14522	13503	12903
% time of inflow	35%	34%	54%	53%	52%
Volume outflow (ac-ft/yr)	32635	35202	7291	8187	8894
% time of outflow	65%	66%	46%	47%	48%
With Project with 50 years of Intermediate rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	28332	25659	15172	14131	13480
% time of inflow	36%	35%	56%	55%	54%
Volume outflow (ac-ft/yr)	41868	45382	7324	8397	9234
% time of outflow	64%	65%	44%	45%	46%
With Project with 50 years of High rate of RSLR					
Reach (cut)	SE1-1	SE1-2	NE2-1	NE2-2	NE2-3
Storage area	SE-1	SE-1	NE-2	NE-2	NE-2
Volume Inflow (ac-ft/yr)	36013	33138	15622	14617	14028
% time of inflow	39%	38%	56%	54%	52%
Volume outflow (ac-ft/yr)	57802	63338	74145	9374	11222
% time of outflow	61%	62%	44%	46%	48%

Table 4.3 Stage Duration with RSLR, Storage Area SE-1

	No Action Plan						With Project Plan					
Without RSLR												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	213	2283	2742	2935	3059	3151	1352	2390	2770	2950	3070	3160
% time at or below WSE	6%	62%	75%	80%	84%	86%	37%	65%	76%	81%	84%	86%
Consecutive Days at or below WSE	73	120	138	164	203	204	114	121	152	164	203	205
With Project with Low rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	15	60	89	120	0	8	62	104	162	206
% time at or below WSE	0%	0%	0%	2%	2%	3%	0%	0%	2%	3%	4%	6%
Consecutive Days at or below WSE	0	0	2	7	9	12	0	2	7	10	16	22
With Project with Intermediate rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	3	7	0	0	3	12	24	38
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Consecutive Days at or below WSE	0	0	0	0	1	2	0	0	1	3	3	3
With Project with High rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.4 Stage Duration with RSLR, Storage Area NE-2

	No Action Plan						With Project Plan					
Without RSLR												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	241	2306	2834	3027	3144	3233	1750	2501	2865	3032	3153	3236
% time at or below WSE	7%	63%	78%	83%	86%	88%	48%	68%	78%	83%	86%	89%
Consecutive Days at or below WSE	64	148	184	203	204	205	117	150	185	204	204	205
With Project with Low rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	2	63	140	205	285	0	11	77	144	214	289
% time at or below WSE	0%	0%	2%	4%	6%	8%	0%	0%	2%	4%	6%	8%
Consecutive Days at or below WSE	0	2	8	12	17	22	0	5	8	12	17	22
With Project with Intermediate rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	1	19	40	60	0	0	4	23	42	66
% time at or below WSE	0%	0%	0%	1%	1%	2%	0%	0%	0%	1%	1%	2%
Consecutive Days at or below WSE	0	0	1	3	3	8	0	0	2	3	3	5
With Project with High rate of RSLR (50 years)												
Water Surface Elevation (WSE) feet	1.0	1.1	1.2	1.3	1.4	1.5	1.0	1.1	1.2	1.3	1.4	1.5
Total Days in Simulation	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654	3654
Total days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0
% time at or below WSE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consecutive Days at or below WSE	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.5 presents estimates of the time in years to permanent inundation for the No Action Plan and With Project Plan (conditions are nearly the same for both swamp areas). These estimates do not consider a rate for biomass and mineral sediment accretion. Biomass and mineral sediment accretion could extend the timeline until permanent inundation.

Table 4.5 Years to Permanent Inundation

RSLR Case	RSLR Year 50	No Action	With Project
Low Rate	1.5 feet	14 years	40 years
Intermediate Rate	1.9 feet	12.5 years	31 years
High Rate	3.2 feet	8 years	17 years

5.0 FLOOD RISK

5.1 General

Flooding problems in the study area are primarily associated with high discharges and stages on the Amite River. (Back- water flooding can affect the study area due to high coastal storm driven stages on Lake Maurepas.) FEMA Flood Insurance Rate Maps show that study area Base Flood Elevations (BFE) range from 6 to 9 feet NAVD-88.

Taylor Engineering used the HEC-RAS geometry models described in Chapter 3 to assess potential impacts to current flood risk in the study area by comparing flood stages for the No Action Plan versus With Project Plan. The HEC-RAS models of the study area simulate the swamps as storage areas and connect the storage area to the ARDC with the proposed exchange channels. These models simulate the flow into and out of the swamp (storage area) under low-to-normal flow and stage conditions. During a major flood event, flow characteristics change from off channel storage to conveyance. This model does not treat the swamp areas as conveyance features.

5.2 Boundary Conditions

To analyze flood impacts, Taylor Engineering developed flow hydrographs for nine return period storms (1-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year), each with seven-day duration. U.S. Weather Bureau Technical Paper No. 40 (TP-40) and National Weather Service HYDRO-35 provided values of rainfall intensity and duration. HEC-HMS and HEC-RAS models of the Amite River watershed (Taylor Engineering, 2009) were used to compute the inflow hydrographs. The inflow hydrographs used for the upstream boundary conditions were computed upstream of the ARDC. Local inflow hydrographs from within the study area (36 square miles) are insignificant compared to the peak discharge and runoff volume from the Amite River watershed upstream of the ARDC (1,769 square miles). This insignificance precluded the need to factor in local runoff inflows.

As with other simulations, Taylor Engineering used Lake Maurepas as the downstream boundary, and employed an elevated, constant stage of 2.0 feet NAVD-88 (2006.81) for the analysis of all storm events. The average daily stage for the Amite River at Maurepas gage for the 10-year period of January 1, 1999 to December 31, 2008, adjusted to NAVD-88 (2006.81), is 0.76 foot and the mean high water is 1.0 foot.

5.3 Model Results

Figures 5.1 and 5.2 present stage hydrographs for the 100-year flood event for two swamp areas, SE-1 and NE-2. The hydrograph plots compare the stages for the No Action Plan and the With Project Plan. Figure 5.1 shows that the project increases peak stage in SE-1 by 0.37 foot. Figure 5.2 shows that the project does not change the peak stage in storage area NE-2.

Figures 5.3 and 5.4 illustrate the project impact on 100-year flood stages at two channel locations, Amite River near Old River and ARDC near Amite River. Figures 5.3 and 5.4 show that that the project reduces peak stage at the Amite River near Old River by 0.27 foot, and at ARDC near Amite River by 0.49 foot.

Simulations of the 1-, 2-, 5-, 10-, 25-, 50-, 200-, and 500-year storm events show similar trends in flood impacts: slight increases in stage for the swamp areas and slight decreases in stage for the Amite River and ARDC.

The qualitative nature of these results is consistent with the increased exchange between the ARDC and the swamp for the With Project Plan. Results, however, overstate the magnitude of the With Project impact given the way the model represents the swamp. During a flood event, flow characteristics in overbanks (swamp) change from off-channel storage to conveyance. Results show that the proposed project would not increase the risk of flooding along the Amite River and ARDC.

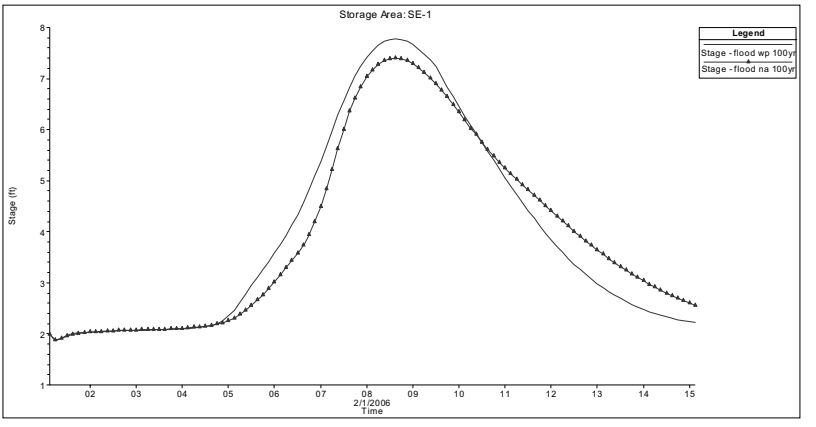


Figure 5.1 Storage Area SE-1

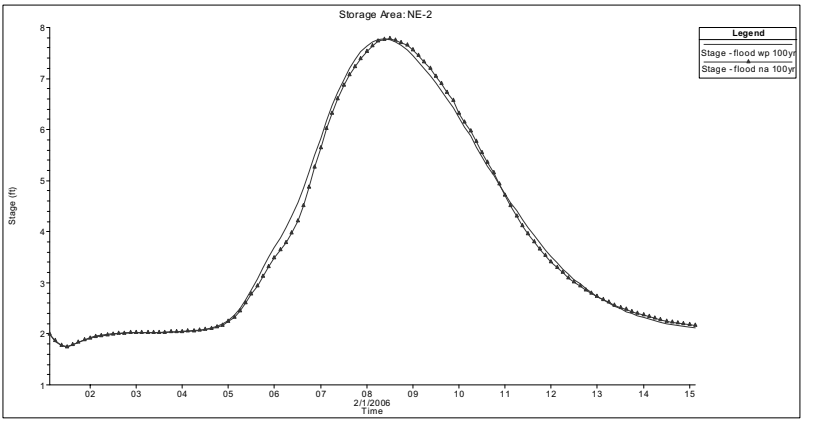


Figure 5.2 Storage Area NE-2

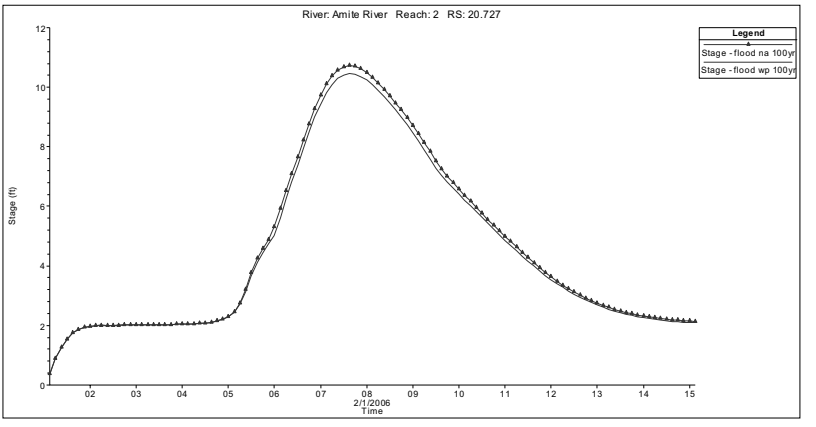


Figure 5.3 Amite River near Old River

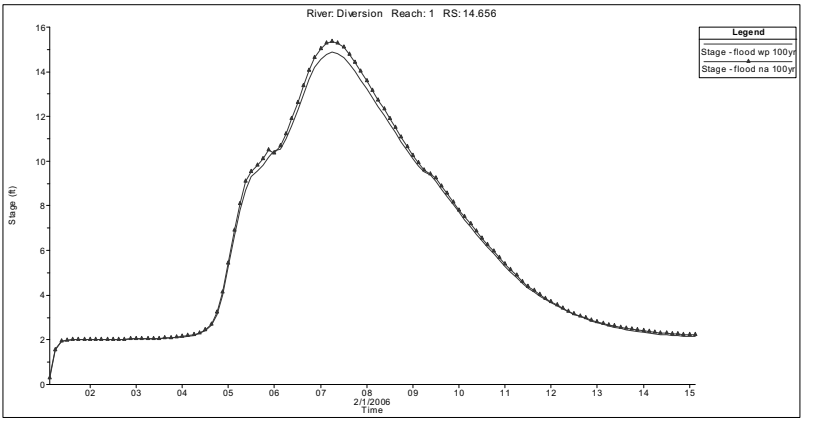


Figure 5.4 ARDC near Amite River

6.0 CONCLUSIONS

The results of the analysis show that the proposed new exchange channels can meet the hydrodynamic objectives of the project. The proposed new exchange channels would improve the conveyance of ARDC water into the swamp, and allow a more natural wetting and drying cycle in the swamp. The effect of RSLR would reduce the improvements in swamp dry periods, with eventual permanent inundation.

The proposed exchange channels may cause a minor increase in peak flood stages in the swamps near the ARDC, and a minor decrease in peak flood stages in the Amite River and ARDC. The Amite River Diversion Canal Modifications would not increase the flood risk.

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Section 3

SURVEY DATA

Existing Surveys

Survey data was collected within the study area as part of the USACE Amite River and Tributaries project in 1956. The data collected gave cross sections and general dimensions for the ARDC, the Amite and Blind Rivers, and the dredged material berms (Survey Annex).

Surveys Obtained

Surveys were obtained inside the study area (Figure 1) of two relict cuts which exist in the eastern portion of subunit SE-2, along Blind River. The surveys collected the cross-sectional dimensions of the relict cuts in order to mimic these dimensions with the proposed bifurcated conveyance channels. The surveys were conducted in two phases. First, GEC obtained a rough estimate of these dimensions, during a site visit in August, 2009. The results of this investigation allowed for the preliminary design process to be conducted, while a full survey of the cuts was in the contract acquisition processes (Figures 1.2 to 1.6). After the initial survey was completed, the full survey was conducted by Shread-Kuyrkendall and Associates in September, 2009 (Figures X – X). The complete survey report is located in the Survey Annex.

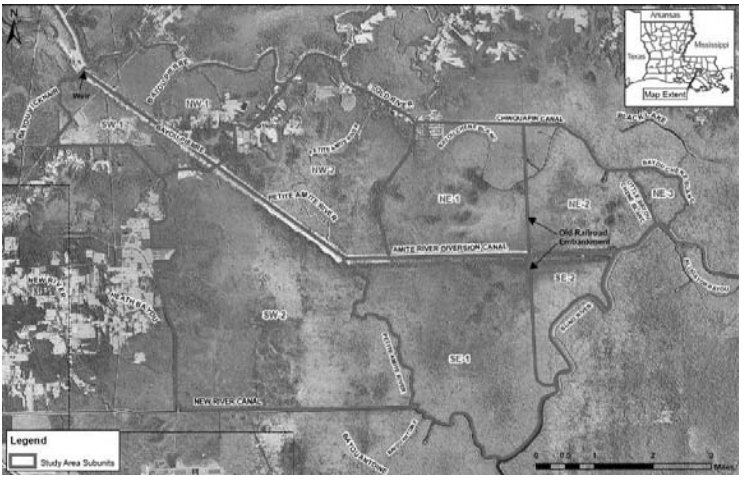


Figure 1. Study Area

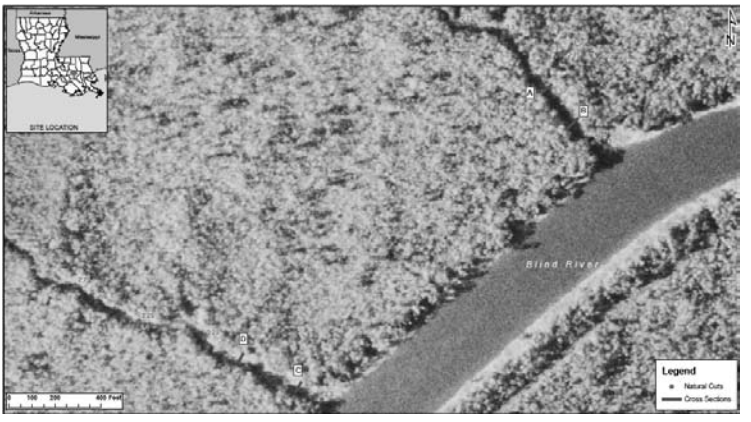


Figure 2. Relict Cut Cross Section Locations

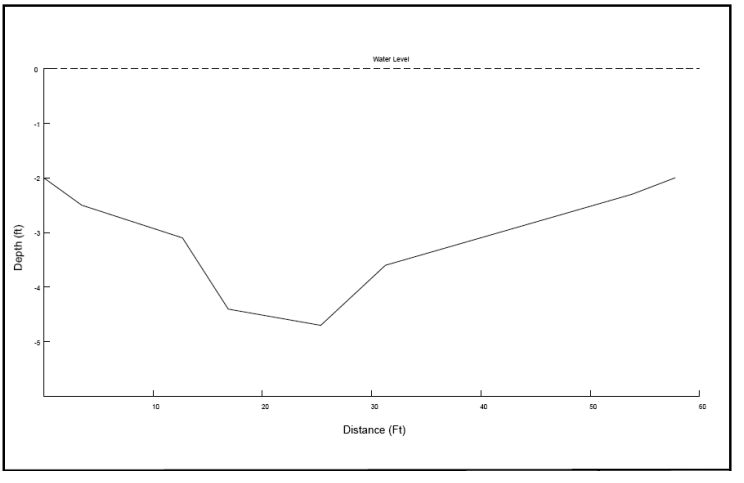


Figure 3. Relict Cut Cross Section A

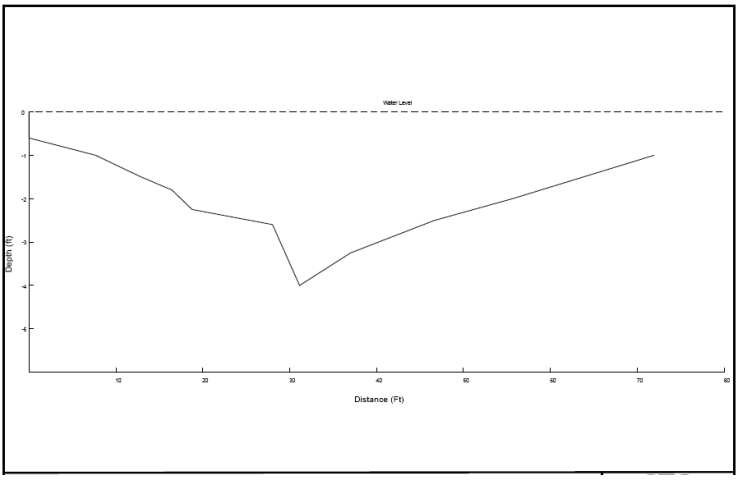


Figure 4. Relict Cut Cross Section C

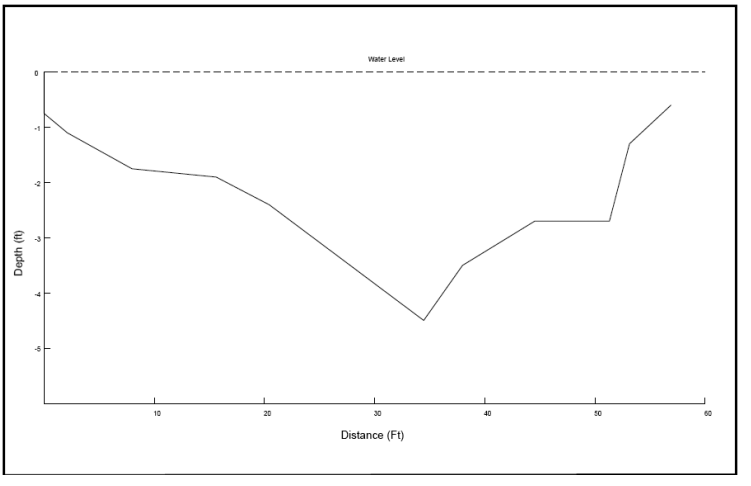


Figure 5. Relict Cut Cross Section D

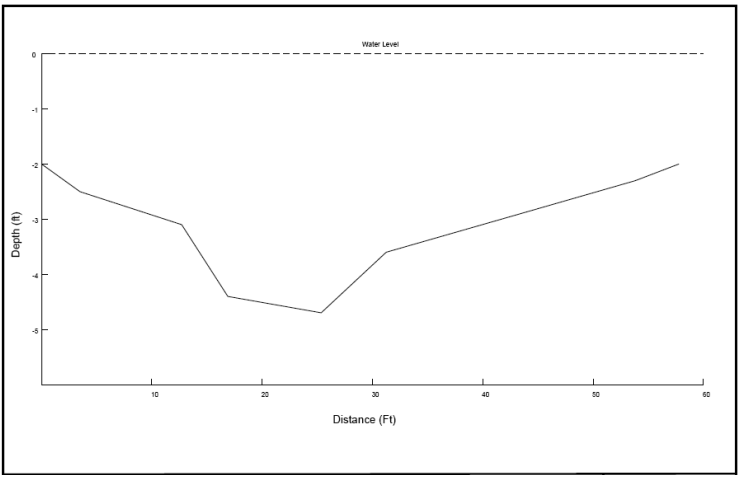


Figure 6. Relict Cut Cross Section D

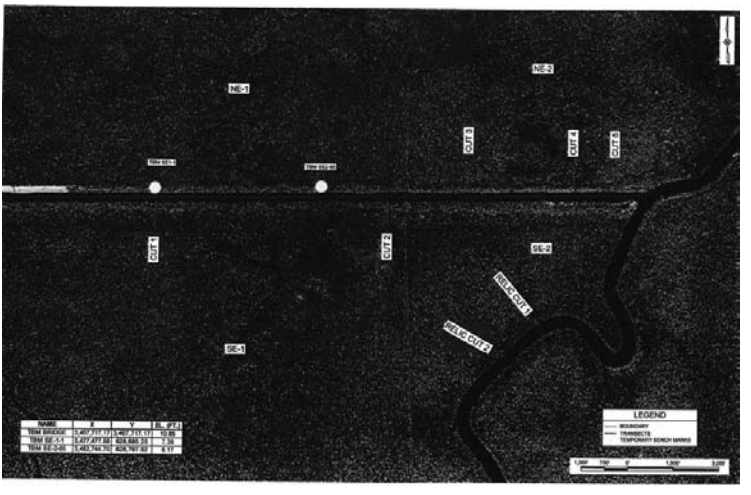


Figure 7. Cross Section Locations for Full Survey

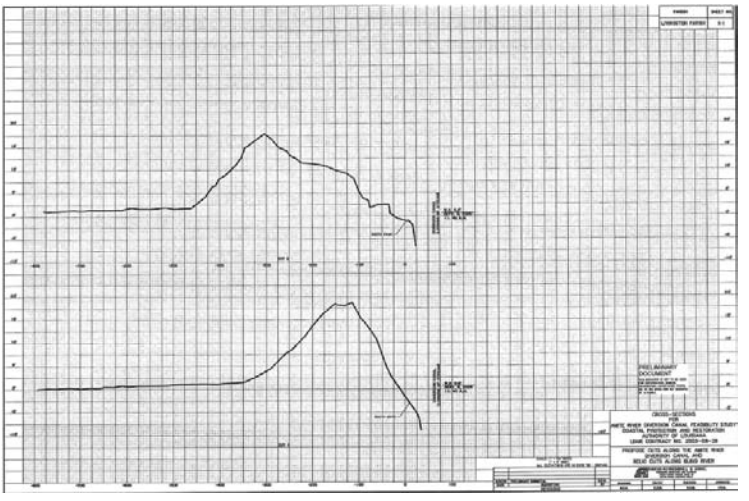


Figure 8. Cross Section of Dredged Material Berm on South Bank

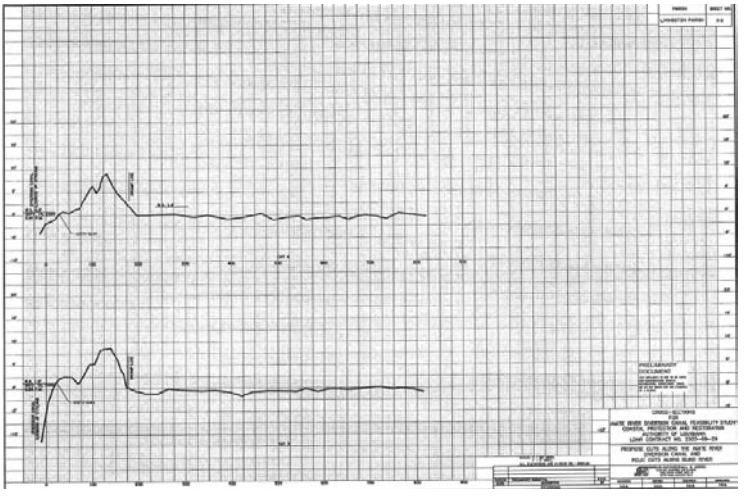


Figure 9. Cross Sections of Dredged Material Berm on North Bank

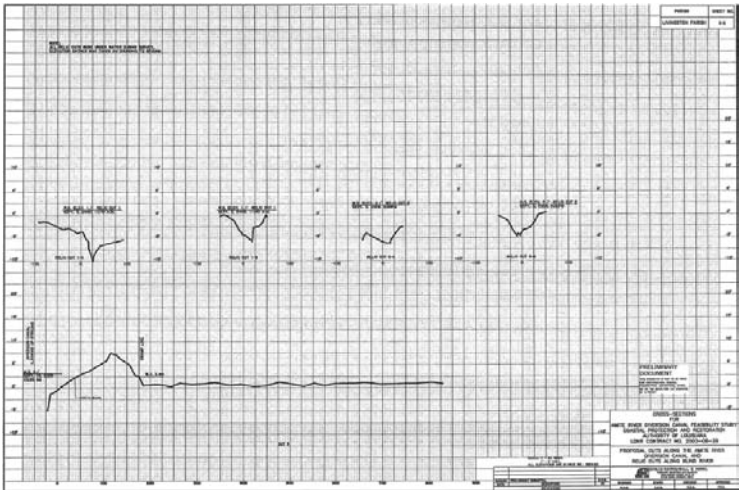


Figure 10. Relict Cut Cross Sections

ANNEX

Survey Data

SURVEY REPORT for
AMITE RIVER DIVERSION CANAL
FEASIBILITY STUDY

Proposed Cuts along the Amite River Diversion Canal
And Relic Cuts along the Blind River

LDNR Contract No. 2503-08-29

SEPTEMBER 28, 2009

Prepare for:

Coastal Protection and Restoration Authority of Louisiana

FINAL REPORT

STATE OF LOUISIANA
FRANK ROBERT STAGG
REG. No. 04529
REGISTERED PROFESSIONAL
LAND SURVEYOR

9/28/09

Frank Robert Stagg, P.L.S. #4529:

Shread-Kuyrkendall & Associates, Inc.
13000 Justice Ave, Suite 16
Baton Rouge, Louisiana 70816
Phone: 225-296-1335

SURVEY REPORT For

AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY

Survey of Proposed Cuts along the Amite River Diversion Canal
And Relic Cuts along the Blind River

Coastal Protection and Restoration Authority of Louisiana

FINAL REPORT – SEPTEMBER 28, 2009

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AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY
Survey of Proposed Cuts along the Amite River Diversion Canal
And Relic Cuts along the Blind River

FINAL REPORT – SEPTEMBER 28, 2009

Section 1: Methodology Report

Coastal Protection and Restoration Authority of Louisiana

PROJECT DESCRIPTION

Louisiana Department of Natural Resources Number 2503-08-29: Survey of proposed cuts along the Amite River Diversion Canal and the Blind River located in Sections 25, 33, 34, & 36, Township 9 South, Range 5 East, and Section 2, Township 10 South, Range 5 East Greensburg Land District, Livingston Parish, Louisiana. On August 19, of 2009, Shread Kuyrkendall and Associates was requested to perform a topographic and bathymetric survey of five proposed cross section locations along the Amite Diversion Canal and four cross section locations at two existing relic cuts along Blind River. A copy of the project scope of work as provided by The Department of Natural Resources is attached in Section 2 of this report.

PROJECT CONTROL

Three temporary survey control monuments for the project were provided by the Louisiana Department of Natural Resources and included horizontal and vertical control datum to be used to establish locations and elevations for the project. The control survey vertical datum is referenced NAVD88 (2004.65). The following project control monuments were provided and used on the project.

Designation	Northing/Y	Easting/X	Elevation
TBM SE1-2-OS	628767.96	3482744.70	8.18'
TBM Bridge	629722.96	3467717.22	10.93'
TBMSE1-1	628685.23	3477477.58	7.40'

KEY PERSONNEL

Wayne Craddock, Field Party Chief
Roy Neal, Field Party Chief
Jimmy Roberts, Field Party Chief
Ralph Burgess, LSI, Project Coordination
Lucas Hudspeth. BS, Survey Processing
Mark Hughes, LSI, Support
Andy Shread, EI, Support
James Parton, AutoCAD
Frank R. Stagg, P.L.S., Project Manager

TASKS

Each of the five cross section locations along the Amite Diversion Canal, Cuts 1 through 5, were to profile a given eight hundred foot transect located ten feet within the water edge, across the existing spoil bank and out into the swamp. Elevations along the transect were obtained at approximate twenty-five foot intervals.

Cross section locations for the Relic Cuts along Blind River, Cuts 1 and 2, were to profile a given one hundred foot transect. Elevations along the transect were obtained at approximate fifteen foot intervals. .

Latitude and longitudes for each transect location were provided by Louisiana Department of Natural Resources as referenced in the Scope of Work shown in Section 2 of this report.

CHRONOLOGICAL SUMMARY OF THE WORK

August 19, 2009	Project Management
August 24, 2009	Project Management
August 27, 2009	Project Reconnaissance
August 29, 2009	Project Reconnaissance
August 31, 2009	Control Survey Calibration

September 2, 2009	Cut Transect Sight Lines
September 3, 2009	Cut Transect Sight Lines
September 4, 2009	Cut Transect Sight Lines
September 8, 2009	Control Cut 1
September 9, 2009	Control Cut 2
September 10, 2009	Control Cut 3
September 14, 2009	Control Cut 4
September 15, 2009	Control Cut 5
September 16, 2009	Project Processing
September 17, 2009	Project Processing
September 18, 2009	Project Processing
September 21, 2009	Project Processing
September 22, 2009	Draft Submittal
September 28, 2009	Final Submittal

EQUIPMENT USED FOR DATA COLLECTION

Sokkia GSR 2700 RSX GPS Unit

Sokkia Set330R

SKA Field Book No. 89179-1

Microstation Inroads – Data Processing

Drawing files – AutoCadd

PROCEDURES AND PROCESSING

Upon completion of project reconnaissance, field crews located the controlling temporary benchmarks provided for the project. The location and elevations of the control marks were verified within the project accuracy and precision requirements and the location of each of the required transects were subsequently established. Control points for each transect were set using Sokkia GSR 2700 RSX GPS. Satellite geometry was not beneficial to use GPS to obtain cross section points because of the clearstory at the project site, thus, these control points were used for occupation and back azimuth with a conventional Sokkia Set330R. Water

surface elevations were obtained and used to confirm elevations established for transect control points. Field crew cut sight lines to collect cross-section data along the transects.

The required transects for the Relic Cuts were completely submerged and transect control points were not established. Field crews utilizing the Sokkia GSR 2700 RSX GPS confirmed the established water surface elevation as verification and established the location and elevations of the transects for the Relic Cuts.

The field surveys were performed under third order accuracy. Field data was processed using Microstation Inroads and cross sections were drafted using AutoCadd. A report was generated in Inroad that identifies point no., State Plane Coordinates (LSZ, ft.), NAVD88 elevation (ft.), and description.

Section 2: RFP/Scope of Work

SCOPE OF SERVICES
TOPOGRAPHIC AND BATHYMETRIC SURVEY

LCA Amite River Diversion Canal Feasibility Study
August 18, 2009

1.0 INTRODUCTION

The Office of Coastal Protection and Restoration (OCPR) of the Coastal Protection and Restoration Authority of Louisiana (CPRA) is responsible for monitoring, maintaining, and operating projects that restore, create, enhance, and maintain coastal wetlands in Louisiana. Tasked with these functions, OCPR is actively developing restoration projects along Louisiana's coasts. The primary goal of the project is to allow floodwaters to introduce additional nutrients and sediment into western Maurepas Swamp through the construction of gaps in the existing dredged material banks of the Amite River Diversion Canal (ARDC). The exchange of flow would occur during flood events on the river and from the runoff of localized rainfall events. This feature would provide nutrients and sediment to facilitate organic deposition in the swamp, improve biological productivity, and prevent further swamp deterioration.

This Scope of Services will provide survey cross-section data to aid in the development and analysis of all proposed project alternatives. Specifically, the contractor shall furnish survey cross-sections for the areas stipulated for each proposed alternative to assist the LCA project team with the development of project costs and to aid in the design process for the Amite River Diversion Canal Modification Project before September 22, 2009.

2.0 LOCATION & ACCESS

This Project is located in the Maurepas Swamp portion of LCA Subprovince 1, west of Lake Maurepas and north of the I-10 corridor (Figure1, Appendix A). The locations of the specific survey cross-sections to be occupied by the Contracting Party are graphically illustrated in Figure 2 of Appendix A.

3.0 SCOPE OF WORK

3.1 Control

The Contracting Party shall conduct all surveying activities using three Bench Marks (TBMs) established by Anthony Cavell utilizing CORS stations and GPS RTK. The locations and elevations of the TBMs are provided in section 3.2.3.

3.2 Survey Overview

This scope of services includes the gathering of cross-sections along 5 proposed cuts in the ARDC spoil bank and two relic cuts along the left descending bank of Blind River as depicted in Figure 2 of Appendix A. Elevation data collected as part of this scope will be used to develop the design and cost for all proposed cuts for the ARDC Modification Project.

3.2.1 Cross-Sections for Proposed Cuts

- Cross-sections for areas of the spoil bank, north and south of the Amite River Diversion Canal will be determined (Figure 2, Appendix A).
- The limits of the cross-sections should be from a point within the canal and 10 ft from the bank, to a point 800 ft. perpendicular into the swamp and beyond the shoreline of the canal.
- All breakpoints between these limits should be accounted for to ensure that all major elevation changes are incorporated into the cross-section.
- Locations along the Amite River Diversion Canal in which cross-sections should be taken are found in Table 1 and Figure 2 (Appendix A).

Table 1. Transect Coordinates for Cross-Sections of Proposed Cuts

Location	DMSLat	DMSLong
Cut 1	30°13'33.94"N	90°42'38.03"W
Cut 1	30°13'25.95"N	90°42'38.76"W
Cut 2	30°13'34.47"N	90°41'12.12"W
Cut 2	30°13'26.46"N	90°41'12.28"W
Cut 3	30°13'44.88"N	90°40'42.46"W
Cut 3	30°13'36.86"N	90°40'42.3"W
Cut 4	30°13'44.99"N	90°40'2.83"W
Cut 4	30°13'36.98"N	90°40'2.58"W
Cut 5	30°13'45.06"N	90°39'47.87"W
Cut 5	30°13'37.04"N	90°39'48.06"W

If vegetation allows GPS RTK surveys shall be referenced to the North American Vertical Datum of 1988 (NAVD 88) and will utilize Geoid03 (2004.65) to determine orthometric heights. The data shall be reported in feet to one decimal place. If conventional survey techniques are necessary, the three TBM's listed in section 3.2.3 will be used to establish the water elevation in the diversion canal and this water surface elevation will be used as the vertical control for the cross sections.

3.2.2 Cross-sections for Relic Cuts

- Multiple cross-sections should be obtained for two relic cuts that occur on the left descending bank of the Blind River (Figure 2, Appendix A).

- A cross-section, perpendicular to the cut, should be obtained 20 feet from the mouth of the relic cut at the point in which it intersects with Blind River. Another perpendicular cross-section shall be obtained 200 feet into the swamp from the mouth of the cut. Each cross-section should depict the elevations for 50 feet in both directions from the centerline of the cut at the designated location.

Table 2. Transect Coordinates for Cross-Sections of Relict Cuts

Location	DMSLat	DMSLong
Relic Cut 1	30°12'55.26"N	90°40'15.2"W
Relic Cut 1	30°12'54.66"N	90°40'16.11"W
Relic Cut 1	30°12'56.83"N	90°40'16.57"W
Relic Cut 1	30°12'56.24"N	90°40'17.48"W
Relic Cut 2	30°12'45.2"N	90°40'29.18"W
Relic Cut 2	30°12'44.31"N	90°40'29.67"W
Relic Cut 2	30°12'45.98"N	90°40'31.02"W
Relic Cut 2	30°12'45.09"N	90°40'31.52"W

3.2.3 Temporary Benchmarks

	Northing/Y	Easting/X	Elevation
TBM SE1-2-OS	628767.96	3482744.70	8.18'
TBM Bridge	629722.96	3467717.22	10.93'
TBMSE1-1	628685.23	3477477.58	7.40'

4.0 DELIVERABLES

4.1 Methodology Report

The Methodology Report shall be in Microsoft Word format, or approved equal, and written to the compact disc (CD). The hard copies shall be signed and stamped by the Registered/Professional Land Surveyor in the State of Louisiana who was directly involved with the project. The hard copies shall be bound in the GPS Survey Report.

The report shall contain but not be limited to the following information: (Include dates for each job task and key personnel involved)

- ***Project Description***
- ***Chronological Summary of the Work***
- ***Information on Secondary Monuments used as reference stations***
- ***Quality control procedures (elevation check)***
- ***Equipment used for data collection***
- ***Downloading and Processing procedures***

4.2 Field Notebook Records

The information to be included in the field notebook will be as follows:

- ***Project Name***
- ***Date of Survey***
- ***Crew Members***
- ***Base Monument Names***
- ***Sketch of Location***
- ***Survey point numbers, descriptions, and elevations observed***

4.3 Drawing Files

Drawings, depicting the cross-sections, elevations, and all appropriate break-points, shall be completed and provided as a requirement of this scope. All variables shall be clearly labeled and accurately plotted. The drawing files shall be in digital format such as AutoCAD (*.dwg or *.dxf) and written to compact disc (CD) along with hard copies each bound in the final Survey Report and folded to fit within the 8½" x 11" methodology report.

Additional information to be included on the Cross-Section drawings will be as follows:

- ***Project Name***
- ***Contractor Name***
- ***Horizontal and Vertical Datum***
- ***Drawing Date***
- ***Drawing Scale***
- ***North Arrow***

4.4 Survey Data

The survey data results shall be reported in Microsoft Excel format arranged in columns and written to compact disc (CD). The file will contain the following columns: Point #, State Plane Coordinates (LSZ,ft), NAVD 88 elevation (ft), and description.

The Contracting Party shall prepare and deliver one (1) draft copy of the deliverables (including the inserted CD) described above to CPRA/OCPR by September 22, 2009. This draft copy will be sent to the following CPRA/OCPR representative for review:

Tye Fitzgerald
CPRA/OCPR
450 Laurel St., Suite 1501
Baton Rouge, LA 70801

TEL: (225) 342-4496
FAX: (225) 342-6801

Drafts will be reviewed by CPRA/OCPR and four (4) final deliverables will be delivered to CPRA/OCPR one week after receipt of comments.

5.0 CERTIFICATION

All deliverables shall be certified by a professional land surveyor licensed by the State of Louisiana.

SURVEY REPORT For

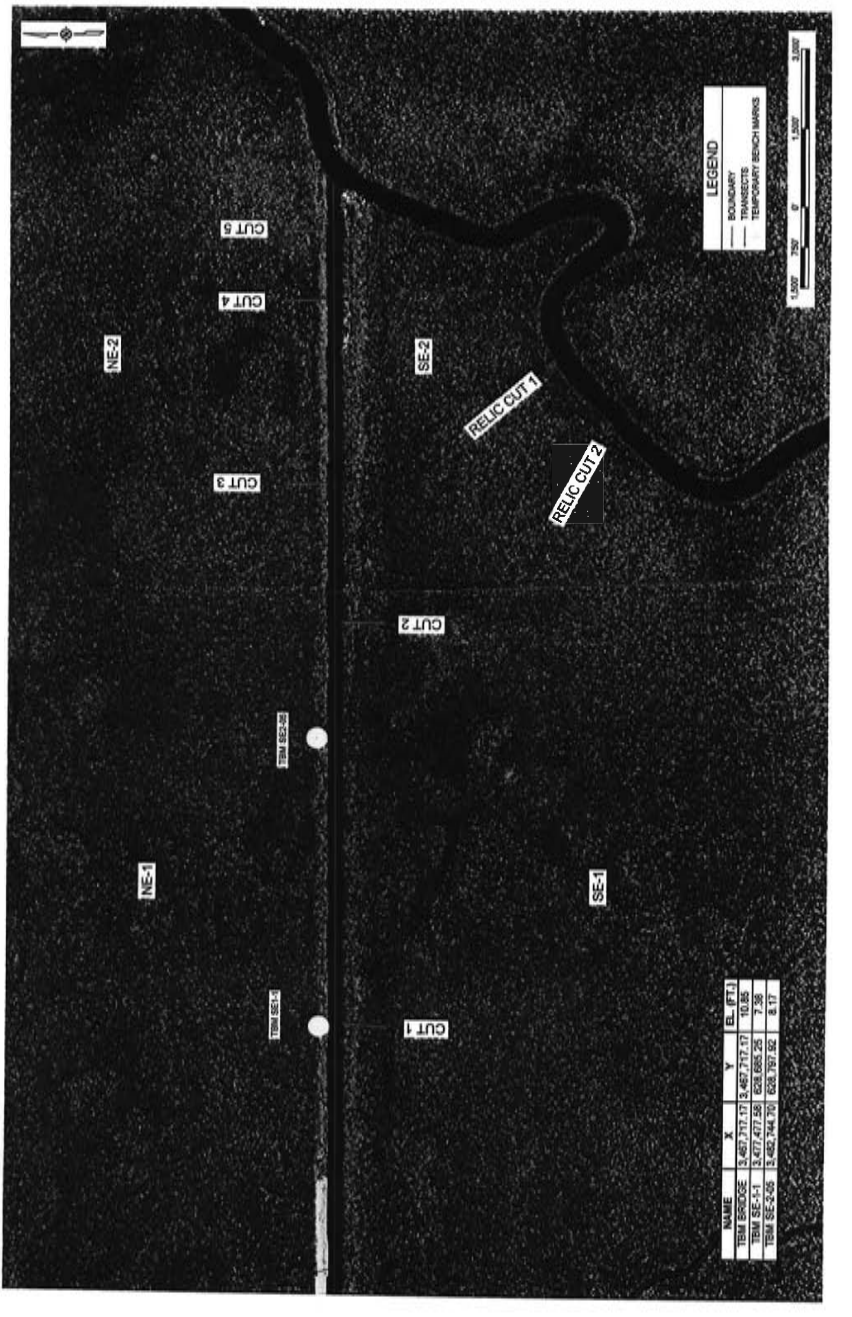
AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY

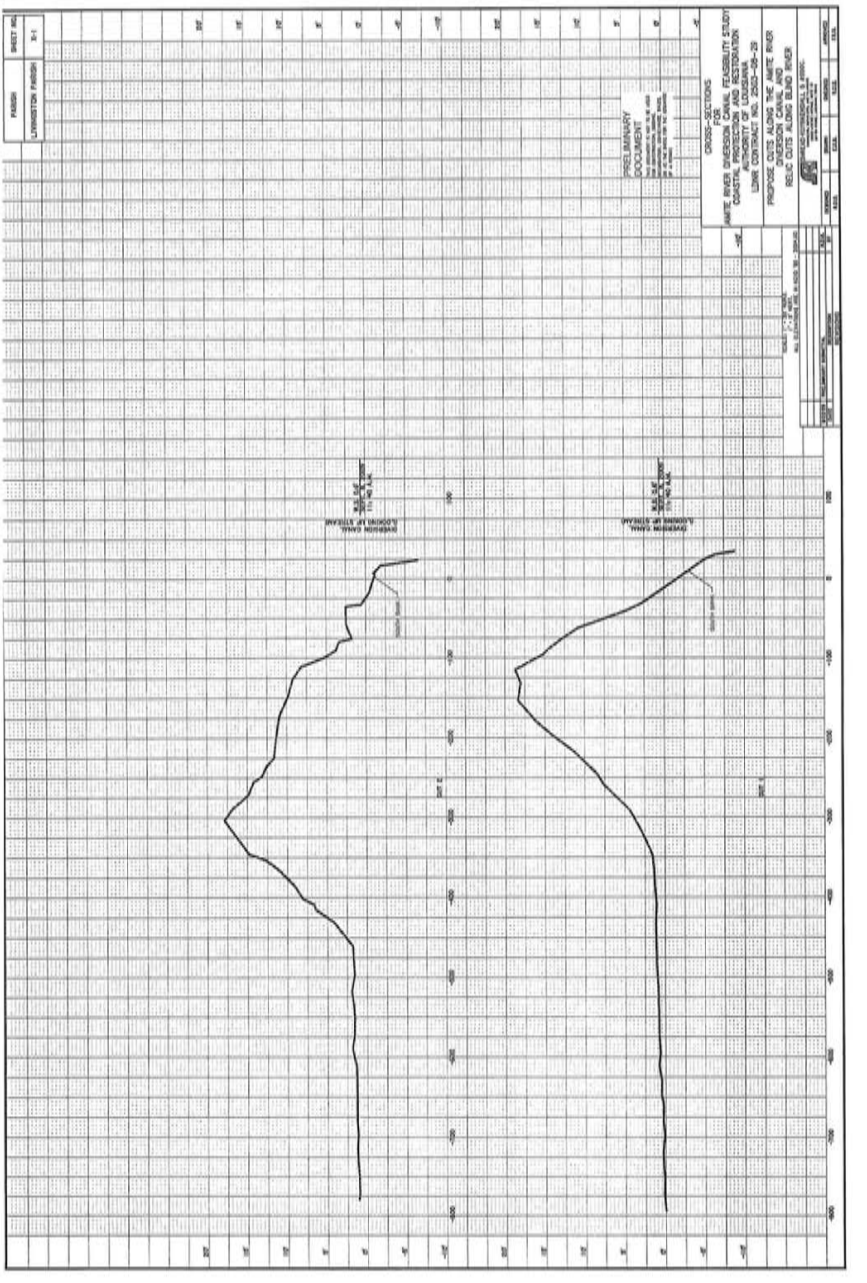
Survey of Proposed Cuts along the Amite River Diversion Canal
And Relic Cuts along the Blind River

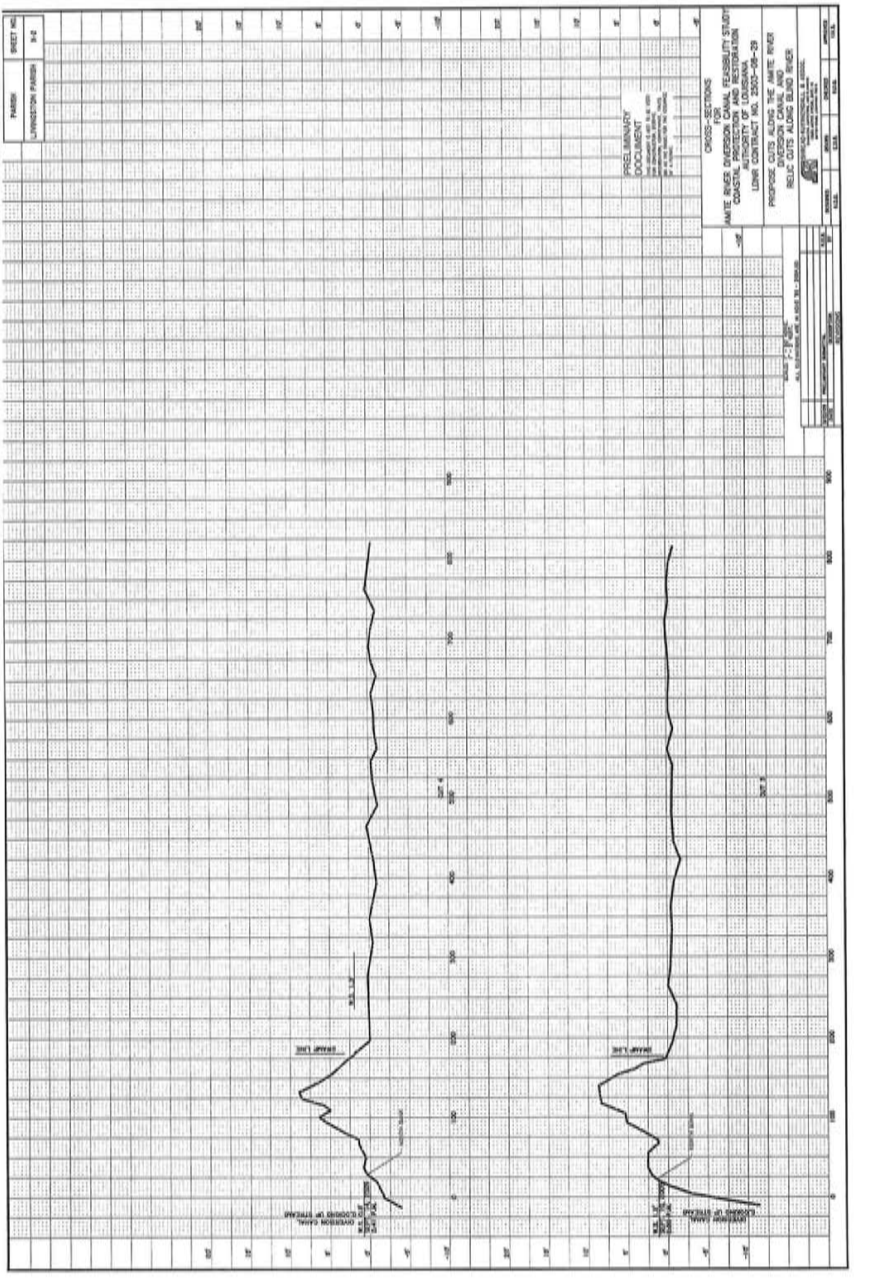
Coastal Protection and Restoration Authority of Louisiana

FINAL REPORT – SEPTEMBER 28, 2009

Section 3: Cross sections


LEGEND
BOUNDARY
TRANSECTS
TEMPORARY BENCH MARKS
NE-2
SE-2
NE-1
SE-1
CUT 1
CUT 2
CUT 3
CUT 4
CUT 5
RELIC CUT 1
RELIC CUT 2
TBM SE-1-1
TBM SE-2-05
NAME X Y EL. (FT.)
TBM BRIDGE 3,467,717.17 3,467,717.17 10.85
TBM SE-1-1 3,477,477.58 628,668.25 7.38
TBM SE-2-05 3,482,744.70 630,797.92 6.17


PARISH
LIVINGSTON PARISH
SHEET NO.
X-1
PRELIMINARY
DOCUMENT
CROSS-SECTIONS
AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY
COASTAL PROTECTION AND RESTORATION
LWI CONTRACT NO. 2503-08-29
PROPOSE CUTS ALONG THE AMITE RIVER
DIVERSION CANAL AND
RELIC CUTS ALONG BLIND RIVER
DIVERSION CANAL
LOOKING AT STAGING
DIVERSION CANAL
LOOKING AT STAGING


PARISH
LIVINGSTON PARISH
SHEET NO.
9-8
CROSS-SECTIONS
AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY
COASTAL PROTECTION AND RESTORATION
LOWER AMITE RIVER
LDNR CONTRACT NO. 2503-06-29
PROPOSE CUTS ALONG THE AMITE RIVER
DIVERSION CANAL AND
RELIC CUTS ALONG BLIND RIVER
PRELIMINARY
DOCUMENT
DRAFT LINE
DRAFT LINE

SURVEY REPORT For

AMITE RIVER DIVERSION CANAL FEASIBILITY STUDY

Survey of Proposed Cuts along the Amite River Diversion Canal
And Relic Cuts along the Blind River

Coastal Protection and Restoration Authority of Louisiana

FINAL REPORT – SEPTEMBER 28, 2009

Section 4: Survey Data

Datum: Horz. - Louisiana State Plane South Zone Feet (1702)
Vertical – NAVD '88 (2004.65)

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103,628680.01340000,3477117.90620000,7.3,TOPO POINT
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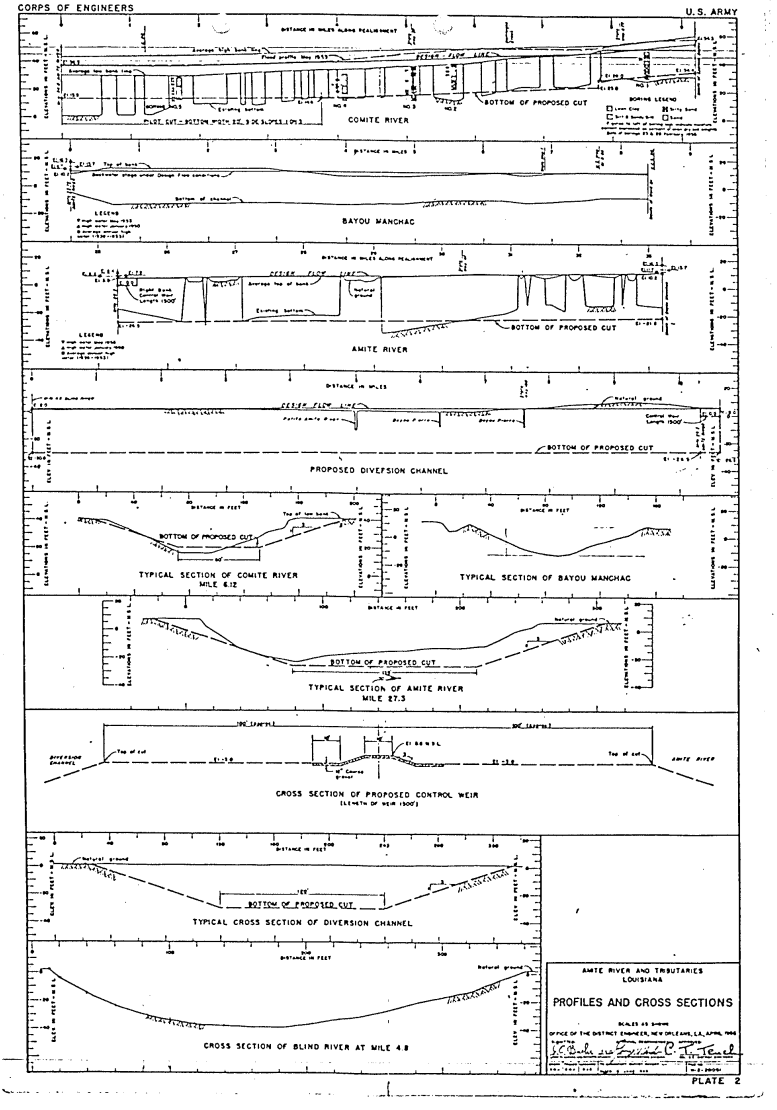
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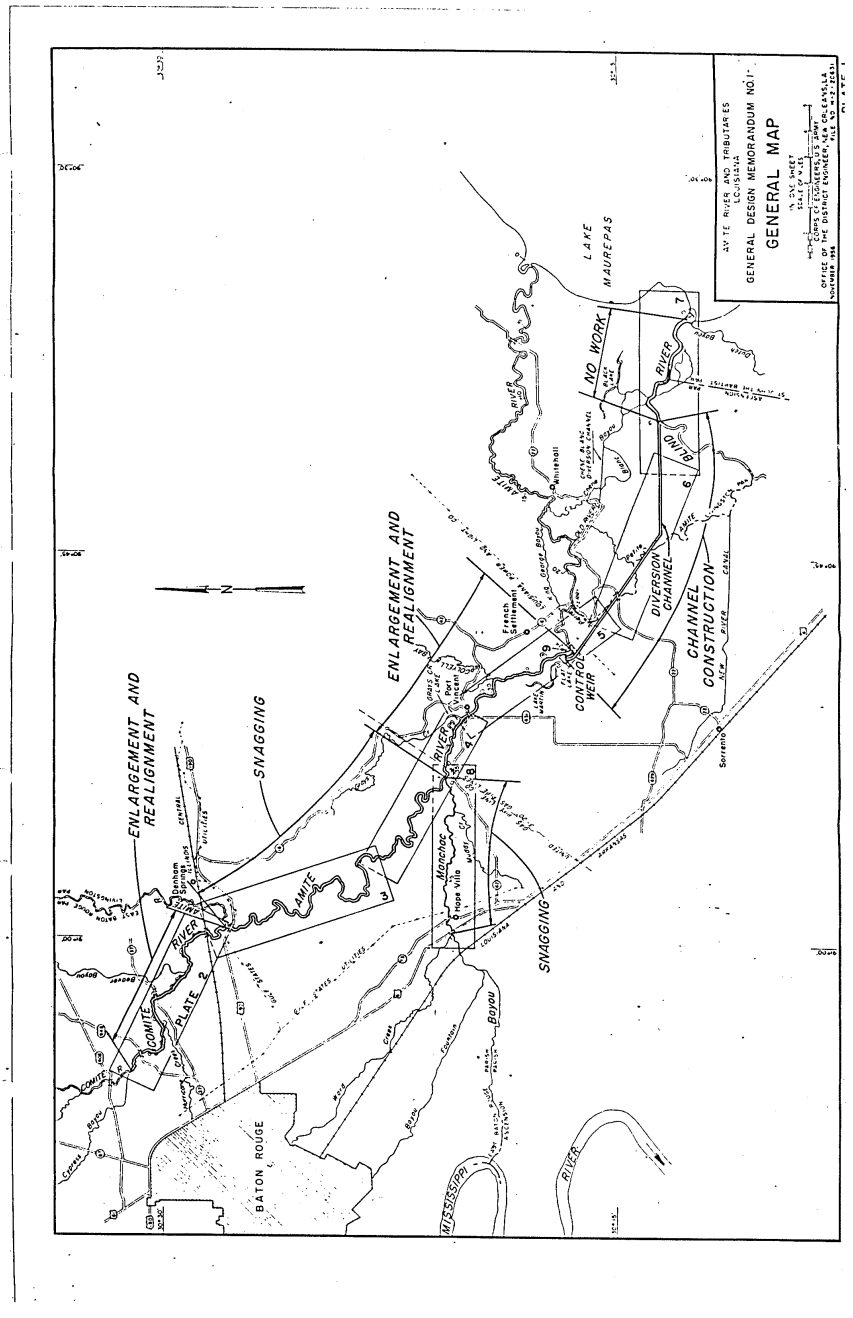
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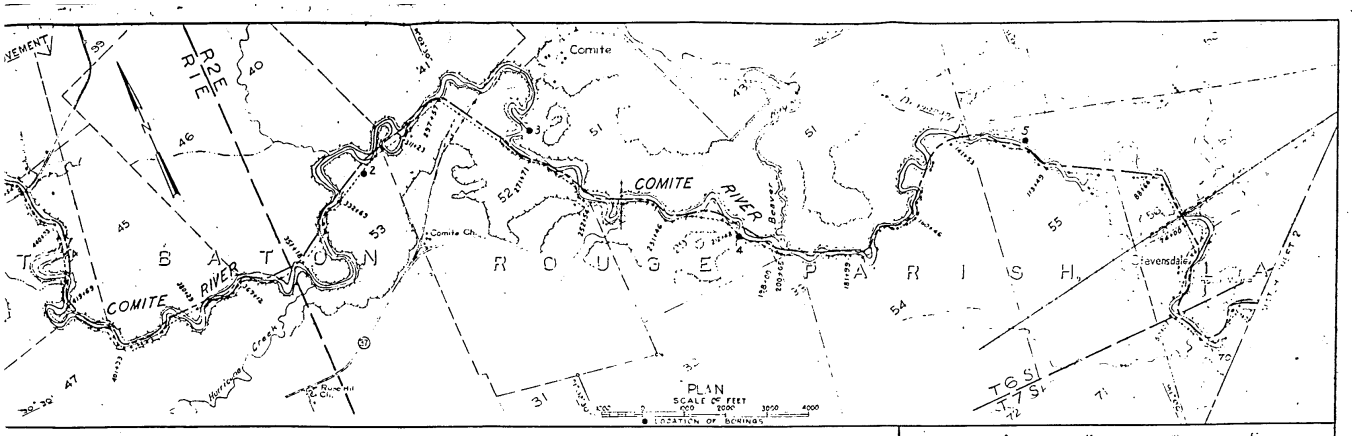
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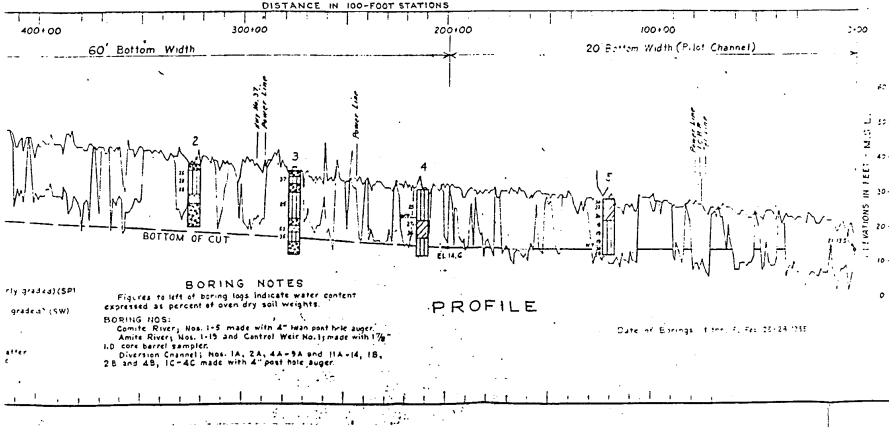
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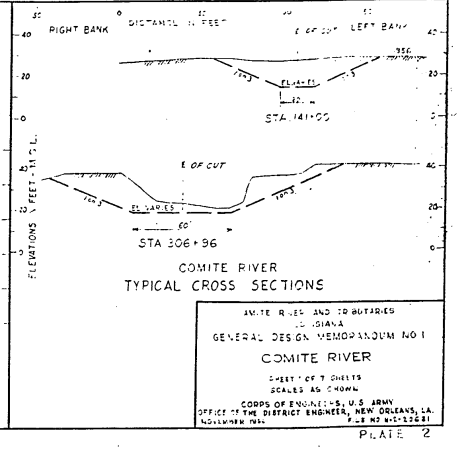
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CORPS OF ENGINEERS
U.S. ARMY
COMITE RIVER
BAYOU MANCHAC
AMITE RIVER
PROPOSED DIVERSION CHANNEL
TYPICAL SECTION OF COMITE RIVER MILE 6.12
TYPICAL SECTION OF BAYOU MANCHAC
TYPICAL SECTION OF AMITE RIVER MILE 27.3
CROSS SECTION OF PROPOSED CONTROL WEIR
TYPICAL CROSS SECTION OF DIVERSION CHANNEL
CROSS SECTION OF BLIND RIVER AT MILE 4.8
AMITE RIVER AND TRIBUTARIES
LOUISIANA
PROFILES AND CROSS SECTIONS
PLATE 2


AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO.1
GENERAL MAP
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
NOVEMBER 1958
ENLARGEMENT AND REALIGNMENT
SNAGGING
ENLARGEMENT AND REALIGNMENT
SNAGGING
CONTROL WEIR
DIVERSION CHANNEL
CHANNEL CONSTRUCTION
NO WORK
LAKE MAUREPAS
AMITE RIVER
COMITE RIVER
PLATE 2
BATON ROUGE
MISSISSIPPI RIVER
Baton Rouge
Denham Springs
Port Vincent
French Settlement
Whitehall
Maurepas
Sorrento
Manchac
Hope Villa
Bayou Manchac
Bayou Conway
Bayou Fountain
Bayou Plaquemine
Bayou Braud
Bayou Grosse Tete
Bayou Sorrel
Bayou Pierre
Bayou Duplantier
Bayou Bernard
Bayou Bourbeaux
Bayou Bonfouca
Bayou Lacombe
Bayou Chinchuba
Bayou Castine
Bayou Liberty
Bayou Terre Aux Boeufs
Bayou Des Allemands
Bayou Des Acadiens
Bayou Des Ecores
Bayou Des Allemands
Bayou Des Acadiens
Bayou Des Ecores







BORING NOTES

Figures to left of boring logs indicate water content expressed as percent of oven dry soil weights.

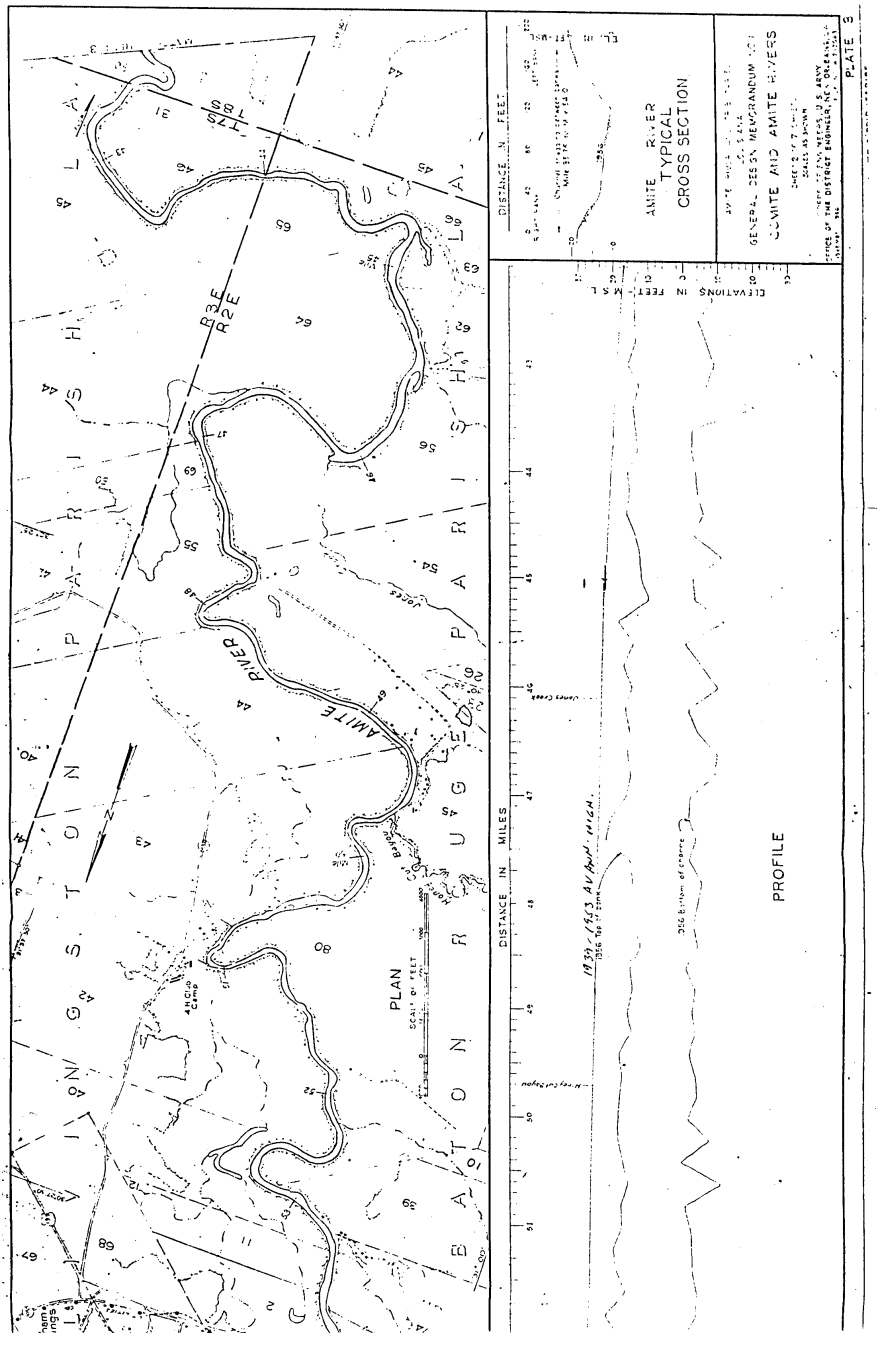
BORING NOS:
Comite Rivers, Nos. 1-5 made with 4" lean post hole auger.
Amite Rivers, Nos. 1-19 and Control Weir No. 1 made with 1 7/8" I.D. core barrel sampler.
Diversion Channel, Nos. 1A, 2A, 4A-9A and 11A-14, 1B, 2B and 4B, 1C-4C made with 4" post hole auger.

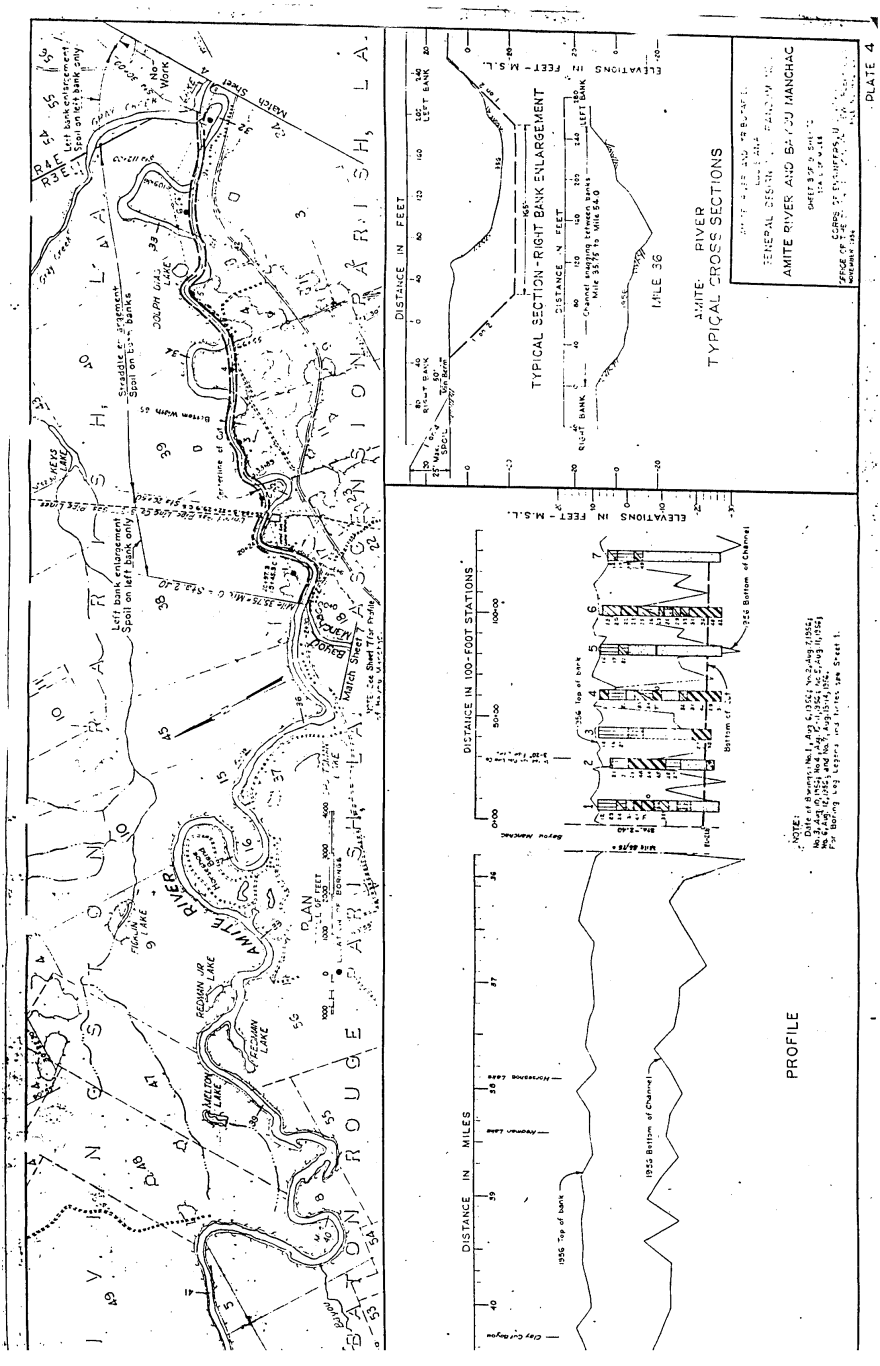
Date of Borings: June 21, Feb 23-24 1938

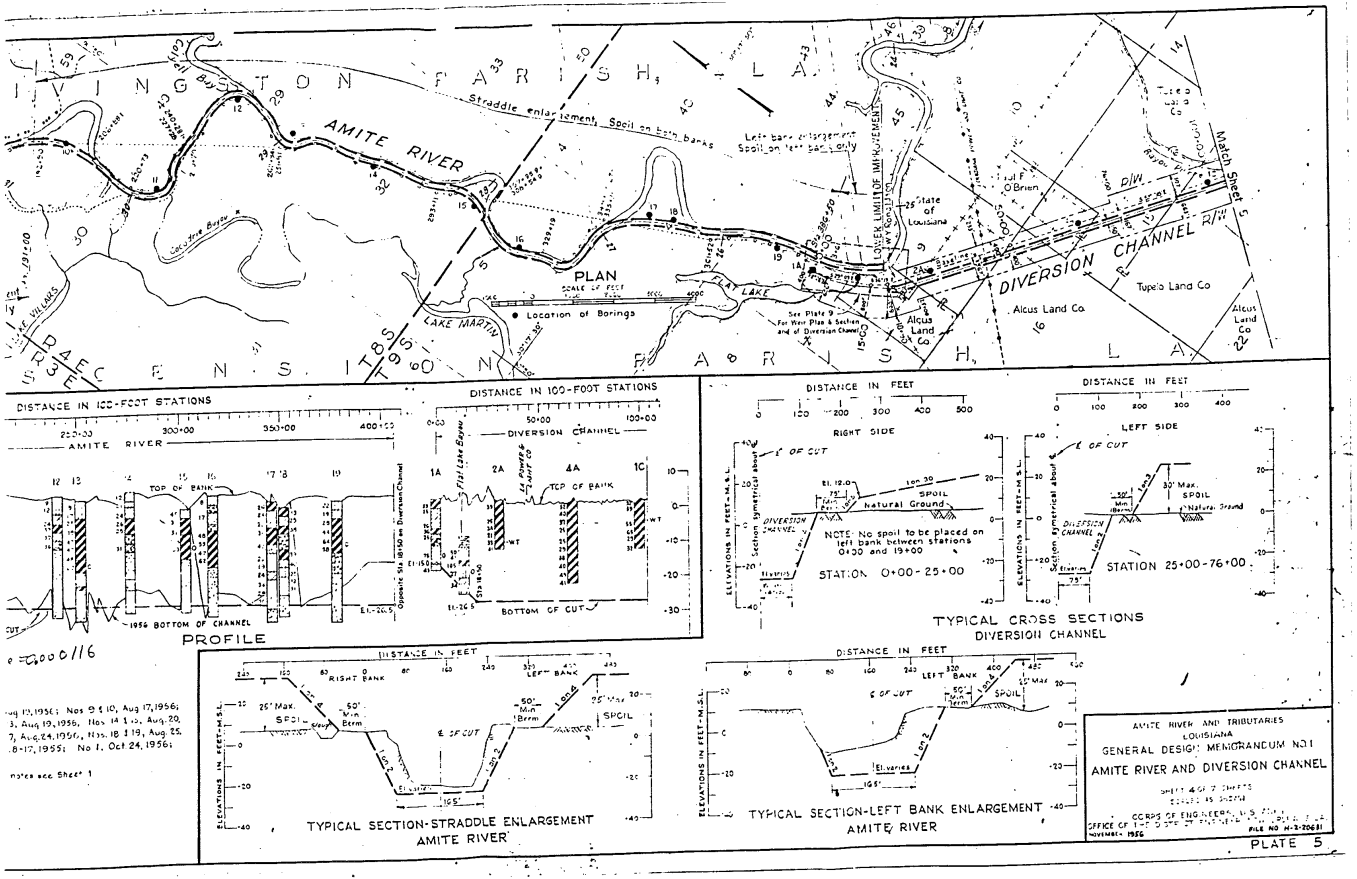
AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO 1
COMITE RIVER
SHEET 1 OF 7 SHEETS
SCALES AS SHOWN
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
NOVEMBER 1964
FILE NO NOE-32681

PLATE 2

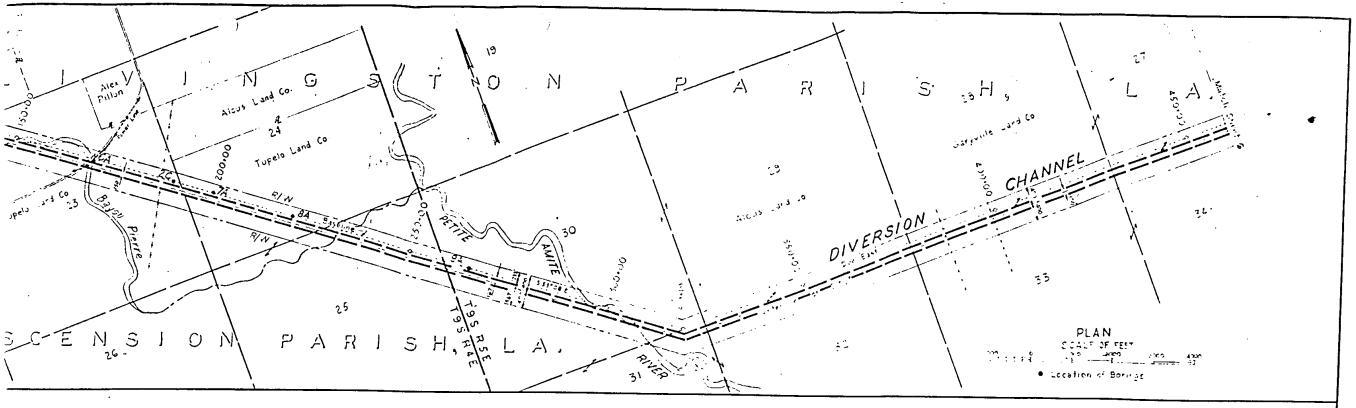
1207

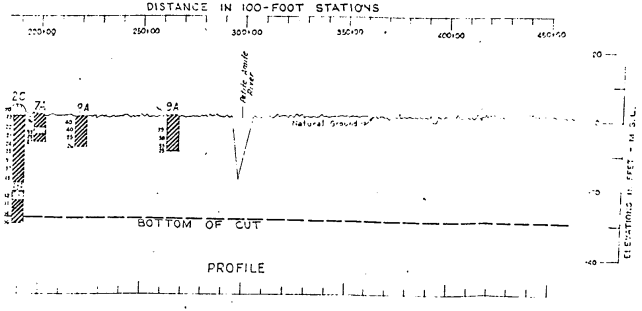

PLAN
PROFILE
AMITE RIVER
TYPICAL
CROSS SECTION
GENERAL DESIGN MEMORANDUM
COMITE AND AMITE RIVERS
PLATE 3
DISTANCE IN MILES
ELEVATIONS IN FEET - M.S.L.
DISTANCE IN FEET
SCALE OF FEET
LOUISIANA
MISSISSIPPI
EAST FELICIANA
WEST FELICIANA
ST. HELENA
ST. TAMMANY
T 6S
T 7S
R 3 E
R 2 E
AMITE RIVER
COMITE RIVER
BATON ROUGE
NEW ORLEANS

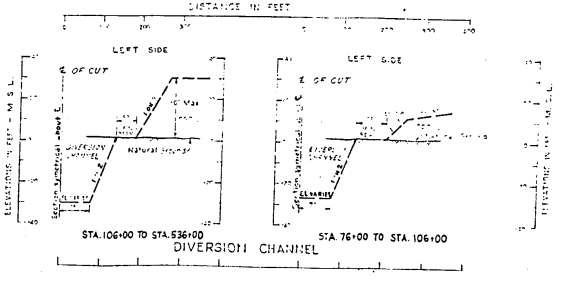

PLAN
PROFILE
TYPICAL SECTION-RIGHT BANK ENLARGEMENT
TYPICAL CROSS SECTIONS
AMITE RIVER
AMITE RIVER AND BAYOU MANCHAC
PLATE 4
DISTANCE IN MILES
DISTANCE IN 100-FOOT STATIONS
ELEVATIONS IN FEET - M.S.L.
DISTANCE IN FEET
1955 Top of bank
1955 Bottom of Channel
MILE 36
Left bank enlargement
Spoil on left bank only
Straddle enlargement
Spoil on both banks
No Work
Match Sheet
Match Sheet 2
AMITE RIVER
LIVINGSTON PARISH
EAST BATON ROUGE PARISH
ASCENSION PARISH


AMITE RIVER
Straddle enlargement Spoil on both banks
Left bank enlargement Spoil on left bank only
DIVERSION CHANNEL R/W
PLAN
SCALE OF FEET
Location of Borings
LAKE MARTIN
FLAT LAKE
Alcus Land Co.
Tupelo Land Co
State of Louisiana
O'Brien
Match Sheet 5
See Plate 9 For Work Plan & Sections and of Diversion Channel
DISTANCE IN 100-FOOT STATIONS
AMITE RIVER
DIVERSION CHANNEL
TOP OF BANK
BOTTOM OF CUT
1956 BOTTOM OF CHANNEL
PROFILE
DISTANCE IN FEET
RIGHT SIDE
LEFT SIDE
℄ OF CUT
SPOIL
Natural Ground
NOTE: No spoil to be placed on left bank between stations 0+30 and 19+00
STATION 0+00 - 25+00
STATION 25+00 - 76+00
TYPICAL CROSS SECTIONS
DIVERSION CHANNEL
RIGHT BANK
LEFT BANK
TYPICAL SECTION-STRADDLE ENLARGEMENT
AMITE RIVER
TYPICAL SECTION-LEFT BANK ENLARGEMENT
AMITE RIVER
AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO 1
AMITE RIVER AND DIVERSION CHANNEL
CORPS OF ENGINEERS, U.S. ARMY
NOVEMBER 1956
FILE NO. M-3-20631
PLATE 5

1213





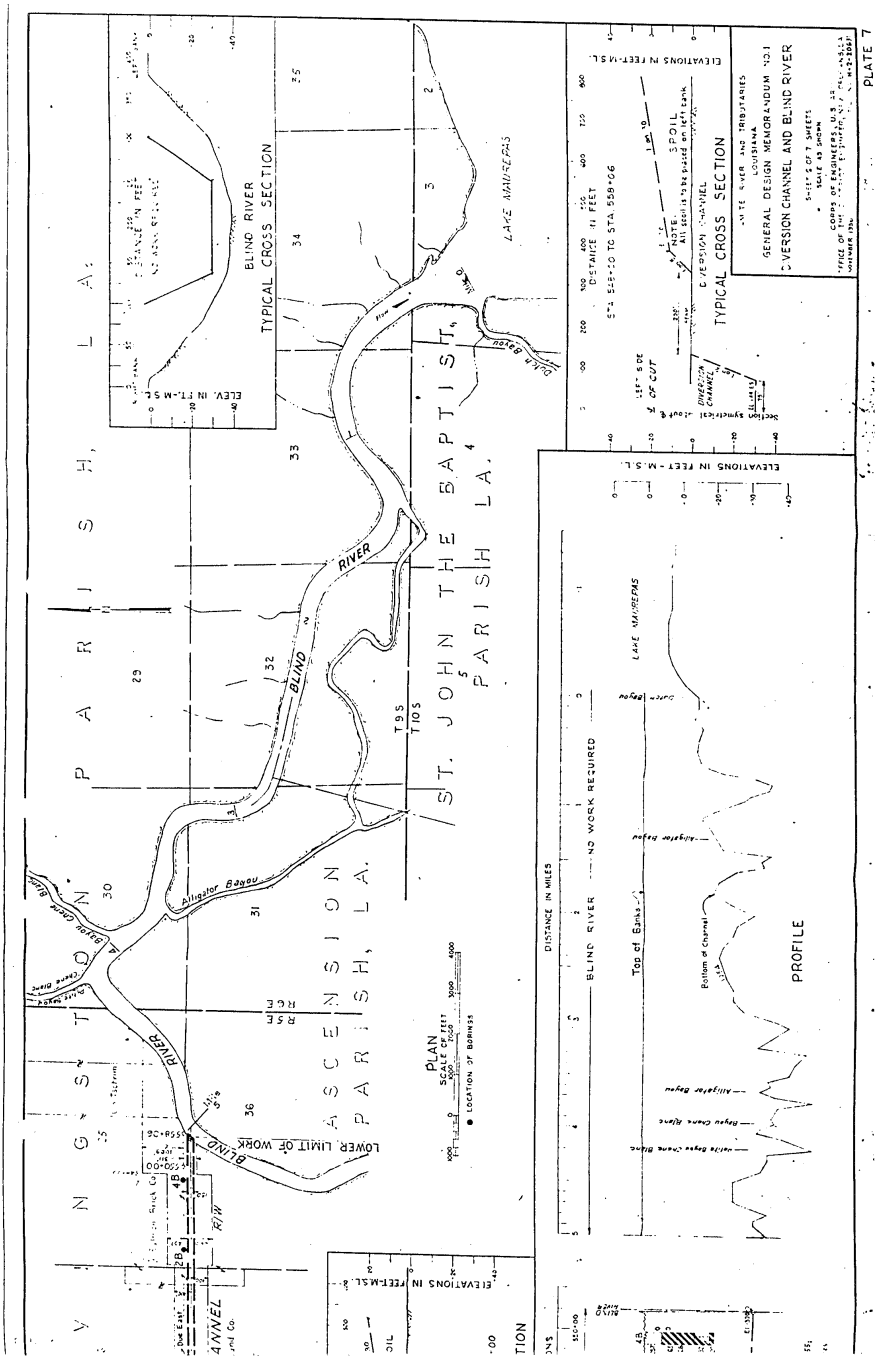


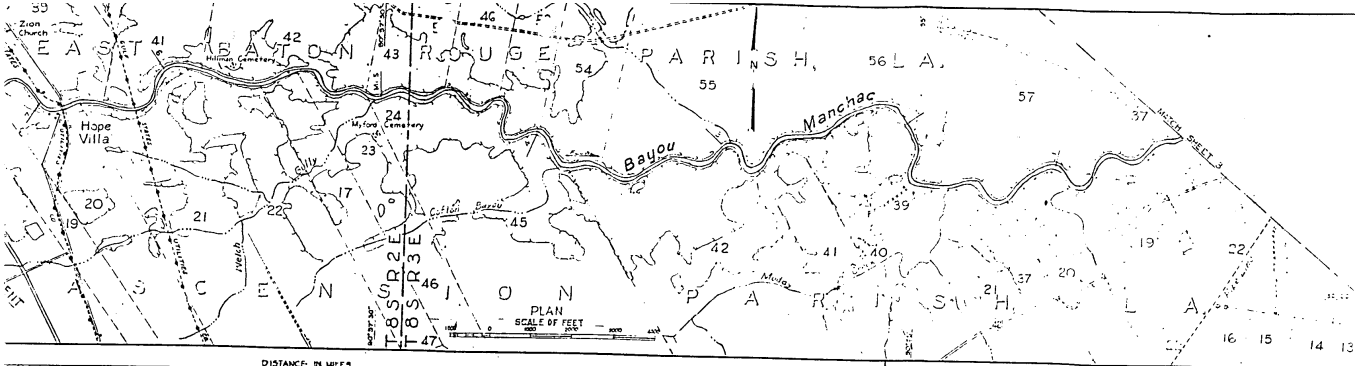
NOTE
Date of borings: 9A to 9A Nov 8-?, 1955
No. 2C July 30, 1956.
For Boring Log Legend and Notes see Sheet 1.

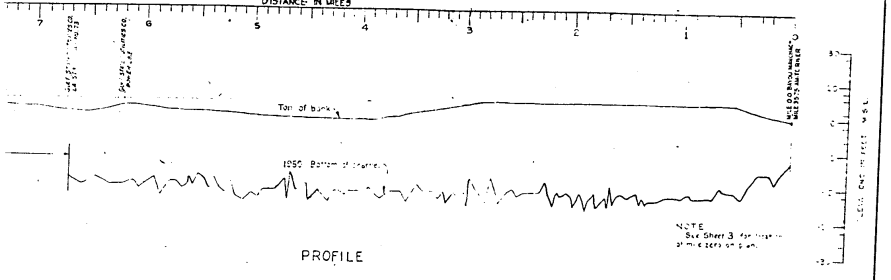
AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO. 1
DIVERSION CHANNEL
SHEET 6 OF 7 SHEETS
SCALE AS SHOWN
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
NOVEMBER 1956

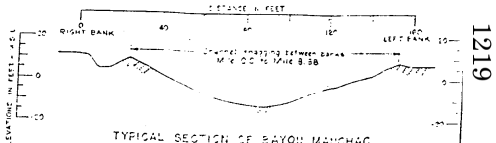
PLATE 6

1215


PLATE 7
GENERAL DESIGN MEMORANDUM NO.1
DIVERSION CHANNEL AND BLIND RIVER
TYPICAL CROSS SECTION
TYPICAL CROSS SECTION
BLIND RIVER
PROFILE
PLAN
ASCENSION PARISH, LA.
ST. JOHN THE BAPTIST PARISH LA.
LAKE MAUREPAS
BLIND RIVER
DIVERSION CHANNEL
LOWER LIMIT OF WORK
NO WORK REQUIRED
Alligator Bayou
Bayou Chene Blanc
RIVER
BLIND
T9S
T10S
R5E
R6E



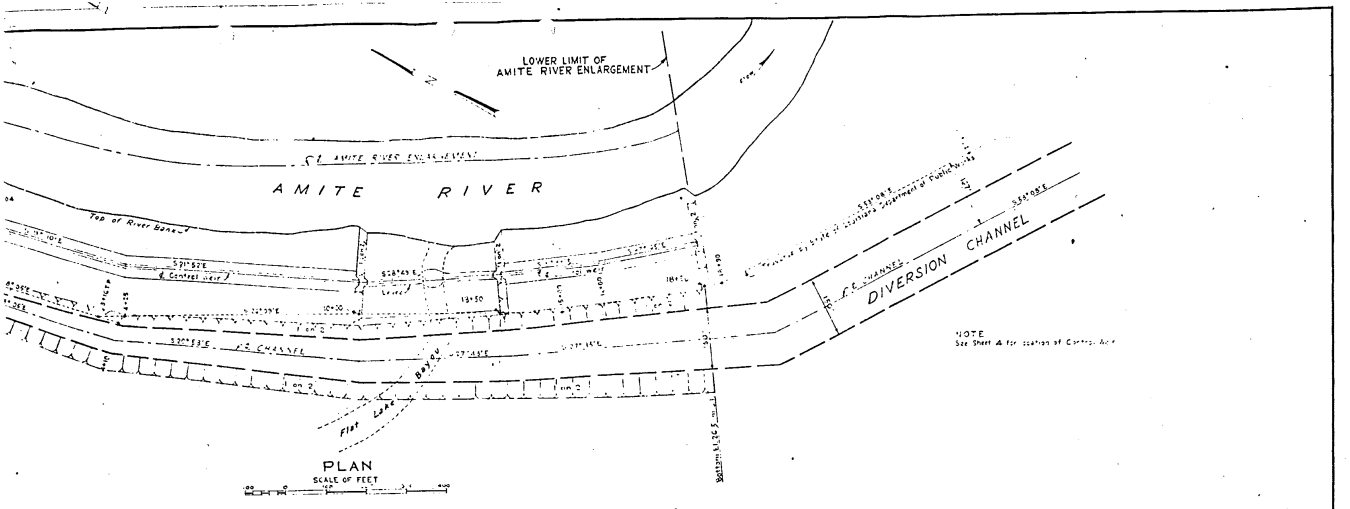


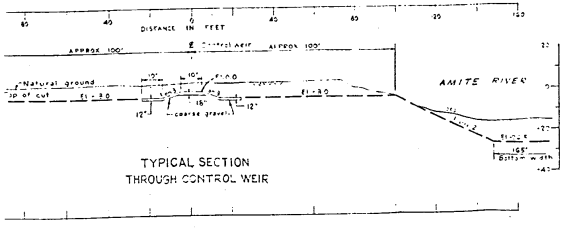


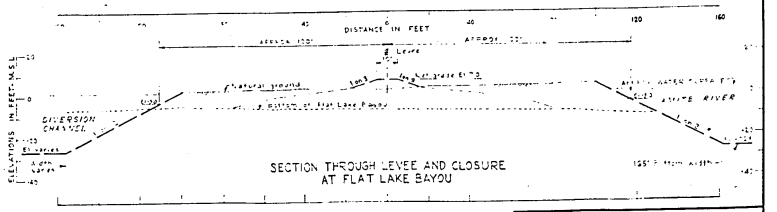
AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO 1
BAYOU MANCHAC
SHEET 7 OF 7 SHEETS
SCALES AS SHOWN
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
NOVEMBER 1956 FILE NO. 1-2063.

PLATE 8

1219







AMITE RIVER AND TRIBUTARIES
LOUISIANA
GENERAL DESIGN MEMORANDUM NO. 1
WEIR PLAN AND SECTION
SHEET
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.

PLATE 9

1221

Section 4

GEOLOGY

Geology

The study area is located in the Maurepas Basin, a component of the Lake Pontchartrain Basin, which is located near the southern terminus of the Mississippi Alluvial Plain physical province. Surface deposits within the Lake Pontchartrain Basin are of Holocene age and are typified by saturated clayey soils with a thin organic surface layer. These Holocene deposits typically overlay Pleistocene alluvial terrace deposits of fine-grained sands and silts derived from alluvium deposited by the proto-Mississippi and other coastal river systems during recent sea level lowstand intervals. Holocene and Pleistocene deposits are underlain by approximately 34,000 feet of sediment and sedimentary rock. These sediments record the outward progression of the Gulf Coastal Plain, and in the case of Pleistocene sediments, the outward building of the Mississippi and proto-Mississippi River Complex. Rivers and streams within the study area exhibit a meandering regime rather than the entrenched or braided regimes observed in areas with higher gradients. Common geomorphologic features in this regime include crevasse splays, point bars, floodplains, abandoned channels, abandoned courses, and backswamps/flood basins. Backswamp/flood basin features are predominant in the vicinity of the study area.

Topography in the western Maurepas Swamp is nearly level, with elevations ranging from mean sea level (msl) to approximately three feet above msl. Topographic survey data collected for the LCA Small Diversion at Hope Canal project immediately east of the study area indicated that point elevations in the surveyed area typically exhibited a random pattern within the narrow range of 0.0 to 1.0 feet North American Vertical Datum, 1988 (NAVD 88), with an average elevation of approximately 0.5 feet NAVD 88. Light Detection and Ranging (LiDAR) data for the study area indicate that the spoil banks along the Amite River Diversion Canal (ARDC) form the topographic high point therein, with an elevation range of approximately 15-20 feet NAVD 88. Developed areas and upland sites, which comprise a minority of land surface within the study area and are primarily located in the western study area, exhibit an average elevation of approximately 5.0 feet NAVD 88. Hydrograph data collected by the Louisiana Department of Natural Resources (LDNR) in 2005 document a gentle gradient from west to east of approximately eight inches in the eastern study area between the Petite Amite and Blind rivers in the direction of Lake Maurepas. A relic railroad grade that traverses the eastern study area from north to south also forms a local topographic high point, with an average elevation of approximately 2.0 feet NAVD 88. Topographic low points within the study area are occupied by sloughs or channels. Channels present within the study area include the ARDC; the Amite, Petite Amite, and Blind rivers; and Bayous Chene Blanc and Pierre. The ARDC was originally dredged to a channel depth of 30 feet below msl. Invert elevations in the ARDC measured by the USACE in its 1985 survey of the Amite River and Tributaries Federal navigation project range from -36 feet to -27 feet National Geodetic Vertical Datum, 1929 (NGVD 29). The Amite River in the vicinity of the study area has invert elevations ranging from -23 to -20 feet NGVD 29. Invert elevations for the Blind River range from -39.5 to -37.0 feet NAVD 88 between the confluence with the Petite Amite River and the confluence with the ARDC, respectively. The Petite Amite River has an invert elevation of -20.5 feet NAVD 88 approximately three miles upstream from the confluence with the Blind River. No bathymetric data are available for Bayous Chene Blanc or Pierre.

Soils are a dominant factor in substrate formation, which in turn influences the type of vegetation communities and land use that may be found within a given area. Of

particular concern are prime farmland soils. The U.S. Department of Agriculture (USDA) defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Soils within the study area are typically hydric clays or mucks that are frequently or continuously flooded. Soils in the Barbary series comprise a plurality within the study area, and substantial quantities of soils within the Fausse and Maurepas series are also present. Four soils within the study area are classified as prime farmland. These soils (Colyell silt loam; Olivier silt loam, 0-1 percent slopes; Olivier silt loam, 1-3 percent slopes; Springfield silt loam) have physical and chemical characteristics that make them ideal for crop production; however, the soils are not present in sufficient quantities within the study area to make them available for crop production. Consequently, these soils do not meet the requirements of prime farmland as defined by the USDA within the study area.

Section 5

GEOTECHNICAL INVESTIGATION

Geotechnical investigations have not been conducted at this time. A Scope of Work has been developed and is approved. The appropriate investigation and analysis is planned to be completed during the Preliminary Engineering and Design phase of this project (PED).

Geotechnical Assumption & Criteria

In the process of developing preliminary designs of proposed alternative plans for the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project, some geotechnical assumptions were made. First, it was assumed that if the cross sections for the proposed conveyance channels were to mimic the cross sectional makeup of relict cuts, found near Blind River, the proposed channels would maintain a hydrologic equilibrium by maintaining flow rates large enough to prevent the buildup of sediments within the channel over the lifespan of the project. Secondly, it was assumed that with a 3H:1V slope and seeding and mulching, the slopes along the dredged material berm openings would remain stable. This is based on the assumption that the berm material is primarily composed of clay, allowing for increased slope stability. The existing slopes on the dredged material berm are between 2:1 and 3:1 and have remained stable. Therefore, until a geotechnical investigation can be completed, it is reasonable to assume that a slope of 3:1 cut into the berm as an opening would remain stable.

Geotechnical Uncertainties

Until a full geotechnical investigation is performed in the PED phase of the project, uncertainties will exist with the assumptions made regarding material placement and slope stability. It is assumed that when material from excavation is placed within the project area, it will be stable enough to create habitat at an elevation sufficient to sustain bottomland hardwood tree species. However, if the material does not maintain the required elevations, a shift in the tree species to be utilized for these plantings will be made to those suitable for a freshwater swamp. Additionally, the stability of channel and placement area slopes will not be known until the full results of a slope stability analysis are completed.

Planned Geotechnical Investigations

A Scope of Work for a planned geotechnical investigation to support the planning and design of the LCA ARDC Modification project has been developed. The investigation will be conducted, during the Preliminary Engineering and Design phase of the project (PED). Investigations will be performed in accordance with USACE geotechnical investigation standards (EM 1110-1-1804, Chapter F, paragraphs 6-5 through 6-7). Lab testing will be conducted in accordance with ER 1110-1-8100 and ER 1110-1-261. The Contracting Party's equipment shall use a fixed-piston type sampling method (Hvorslev fixed-piston or equivalent). An undisturbed type piston sampler shall utilize a minimum of 5- inch Shelby Tubes (5" O.D., approx. 4-3/4" I.D.) that are a minimum of 54 inches in length with sealing caps. The Contractor shall perform global slope stability analyses, soil classification under the Unified Soil Classification System, as well as Triaxial Shear and Consolidated Undrained analysis.

Survey for Geotechnical Investigations

In conjunction with the geotechnical investigation, a land survey will be conducted. The survey will include additional cross sections of the dredged material berm, along with the proposed conveyance channels. The limits of the cross-sections in the spoil bank should be 200' from the center of the proposed cut (for a total cross-section width of 400'). The limits of the cross-sections not in the spoil bank should be 100' from the center of the proposed cut (for a total cross-section width of 200'). Additional cross-sections will be taken on the spoil bank

perpendicular to the spoil bank along the centerline of the proposed cuts. The cross section should be approximately 125' on either side of the center of the spoil bank (for a total cross-section width of 250') at the 3 proposed cut locations on the north side of the ARDC and should show all significant break points of the spoil bank. An additional cross section should be approximately 300' on either side of the center of the spoil bank (for a total cross-section width of 600') at the proposed eastern-most cut on the south side of the ARDC and should show all significant break points of the spoil bank. An additional cross section should be approximately 200' on either side of the center of the existing spoil bank (for a total cross-section width of 400') at the proposed western-most cut on the south side of the ARDC and should show all significant break points of the existing spoil bank. All breakpoints between these limits should be accounted for to ensure that all major elevation changes are incorporated into the cross-section. The Contracting Party shall conduct all surveying activities using three Bench Marks (TBMs) established by Anthony Cavell utilizing Continually Operating Reference Stations (CORS) stations and Global Positioning System Real time Kinematic (GPS RTK).

Section 6

CONCEPTUAL DESIGN ALTERNATIVES EXPLORED

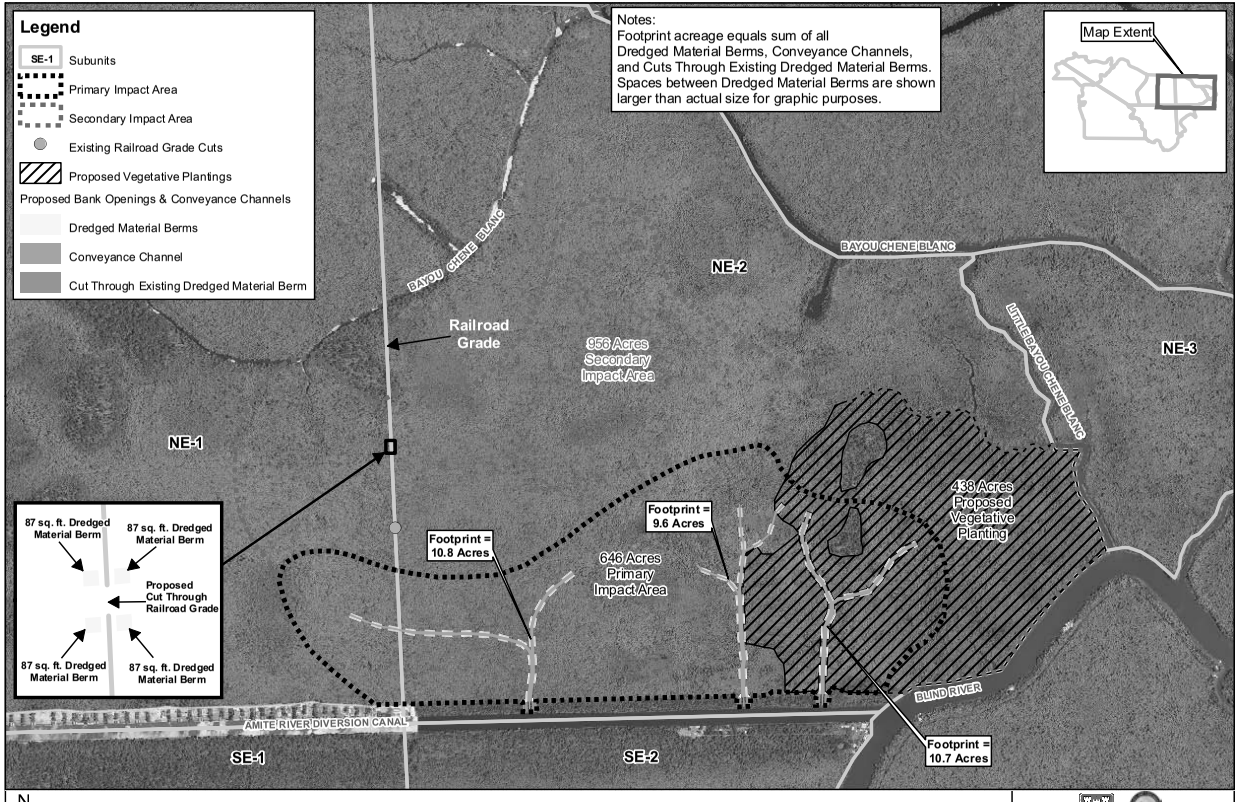
3.0 Alternative 33 (TSP) (NE-1/NE-2)

Alternative 33 (Figure 1) includes:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost channel in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1, NE-2, and the ARDC.
- Dredged material (5.0 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 5.0 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

Three natural low areas or relict channels have been identified as potential bank opening and conveyance channel sites. Openings would enable impounded water to be drained from the swamp and provide hydrologic connectivity between the swamp and the ARDC. Additionally, the placement of a cut in the railroad grade would provide further hydrologic connectivity between NE-1 and NE-2. Openings would promote the introduction of freshwater, sediments, and nutrients into the swamp and allow the oxidation of sediments and removal of toxic metabolites. This alternative is anticipated to improve the degraded swamp and decrease the transition to marsh and ultimately, open water. This alternative represents the minimum effort that would meet the goals and objectives of the project. Alternative 33 would benefit approximately 1,602 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 5.0 acres of upland habitat from dredged material placement.

All excavation through the dredged material berms, as well as the conveyance channels through the swamp, would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. Several existing channels were surveyed for depth, dimension, and profile. These channels have existed for quite some time without any maintenance. The cross-sections include a 70-foot wide cut section with benches through dredged material berm, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches was designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. The quantities associated with each alternative are found in Table 1. Table 2 summarizes the features associated with each alternative within the final array. A typical depiction of the conveyance channels is found in Figure 6.



N

0 1,000 2,000 3,000 Feet

ALTERNATIVE 33

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

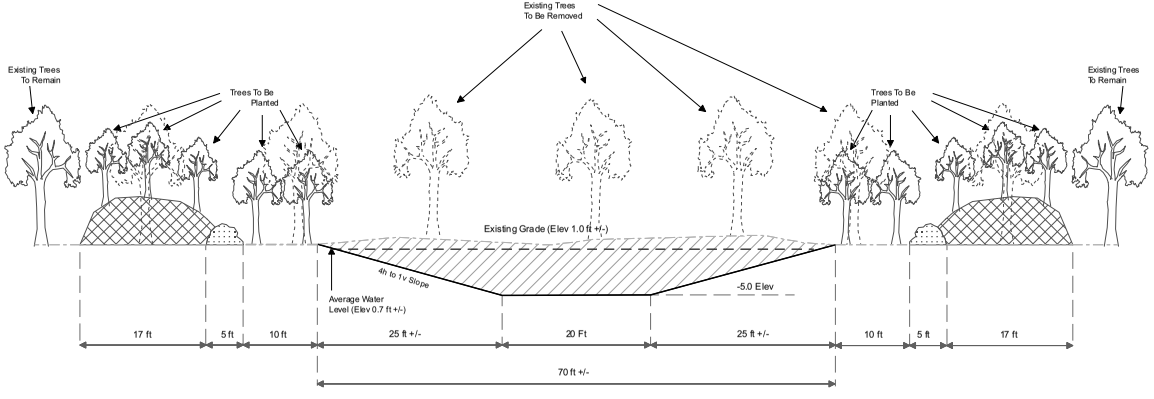
Figure: 1
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1868

Table 1. Alternative Quantities

Alternative	Footprints (Acres)						Excavation (Cubic Yards)*		
	Berm		Swamp						
	Slopes & Benches	Channel	Channel	10' Gaps and Stumps	Material Placement	Total	Dredged Material Berm Cut	Channel Cut	Total
33 1	.8	0.8	17.8	5.8	5.0	31.2	13,753	81,694	95,447
34 2	.5	0.9	9.6	3.1	2.7	18.8	27,867	45,873	73,740
35 1	.8	0.6	6.6	2.1	2.2	13.3	25,527	34,941	60,468
36 4	.3	1.7	27.4	8.8	7.8	50.0	41,620	127,567	169,187
37 4	.3	1.5	16.2	5.2	4.9	32.1	53,394	80,814	134,208
38 3	.6	1.4	24.4	7.9	7.2	44.5	39,280	116,635	155,915
39 6	.1	2.3	34.0	11.0	9.9	63.3	67,147	162,508	229,655

* Does not include changes in volume due to excavation.

1237



Legend

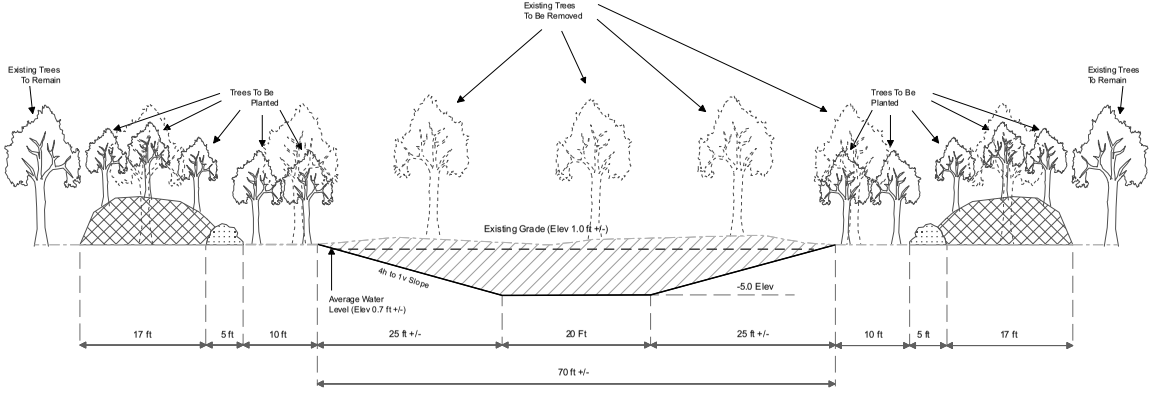
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 70 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 2
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

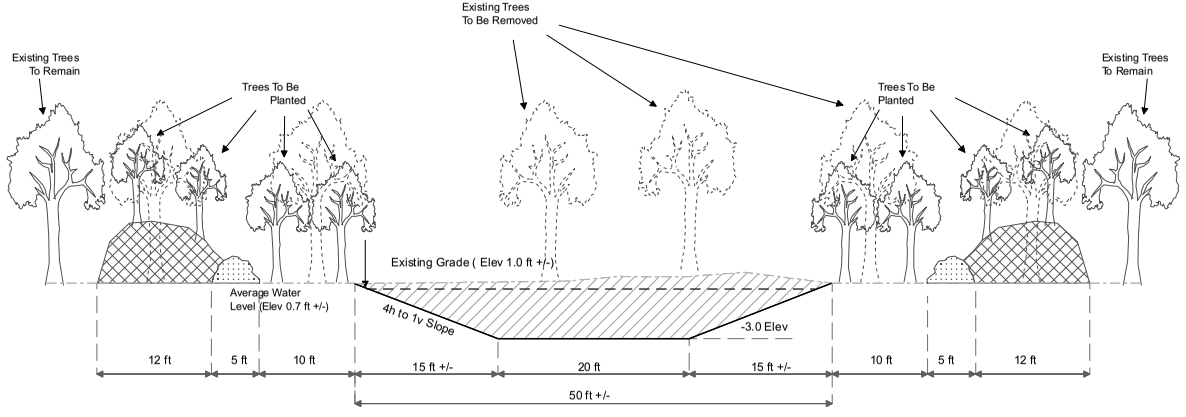
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 70 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 3
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



Legend

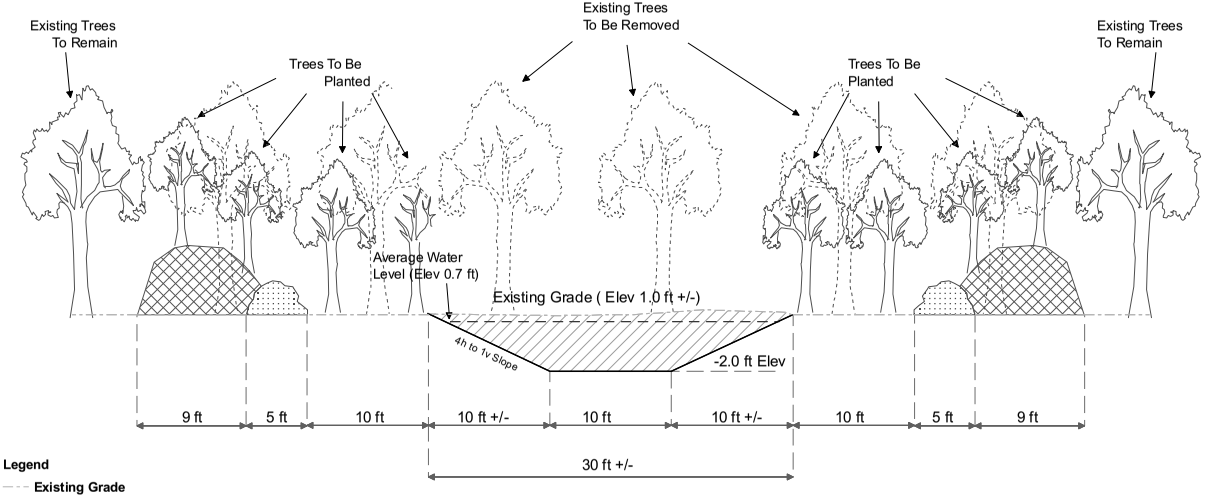
- Existing Grade
- Dimensions
- Average Water Level
- Channel Cut
- Dredge Material Placement
- Stumps
- Dredge Area

Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 50 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 4
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741

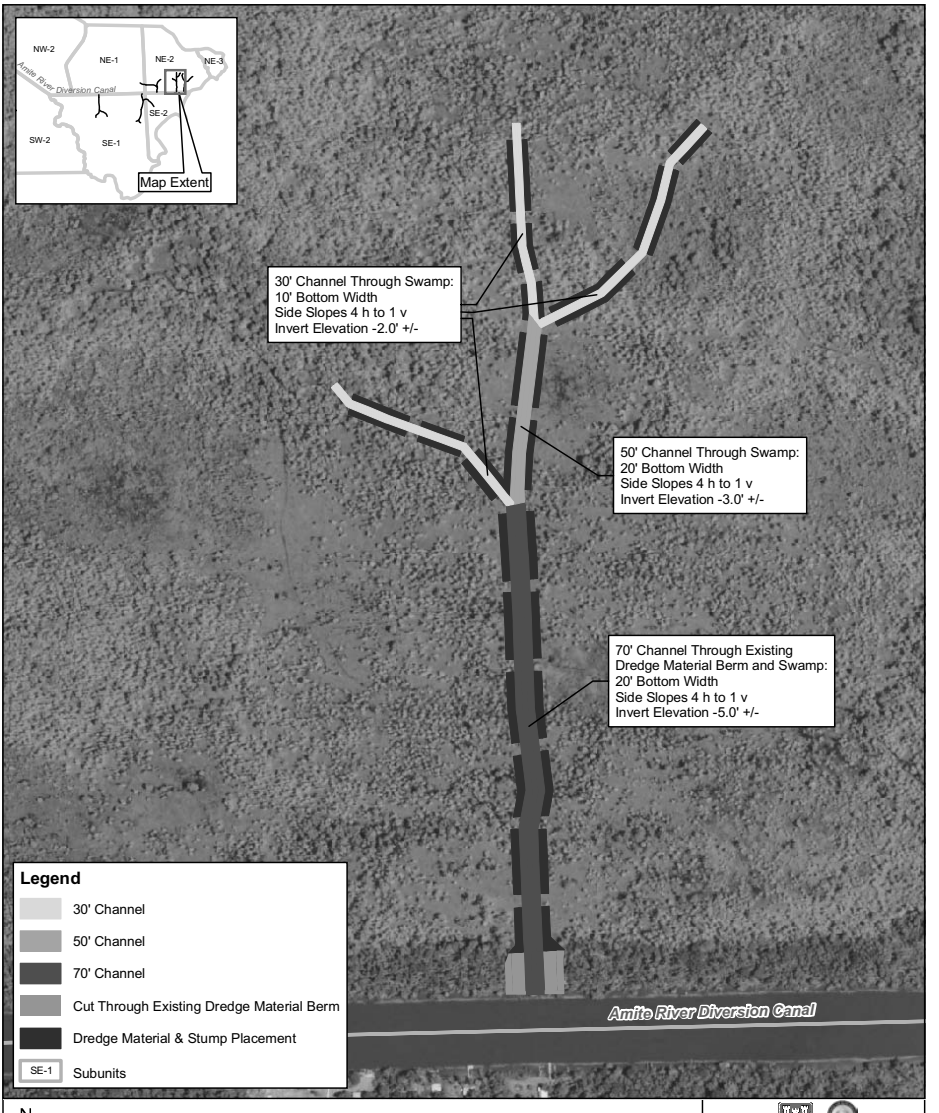


Note: Dredged material to be deposited along the proposed conveyance channel at approximately 300 foot intervals with 50 foot gaps included.

Typical 30 ft. Cross Section through ARDC Native Swamp

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Figure: 5
Date: January 2010
Not to Scale
Source: GEC
Map ID: 27850108-1741



N

0 200 400 600 Feet

TYPICAL CONVEYANCE CHANNEL

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 6
Date: January 2010
Scale: 1:5,600
Source: USDA/GEC
Map ID: 27850108-1889

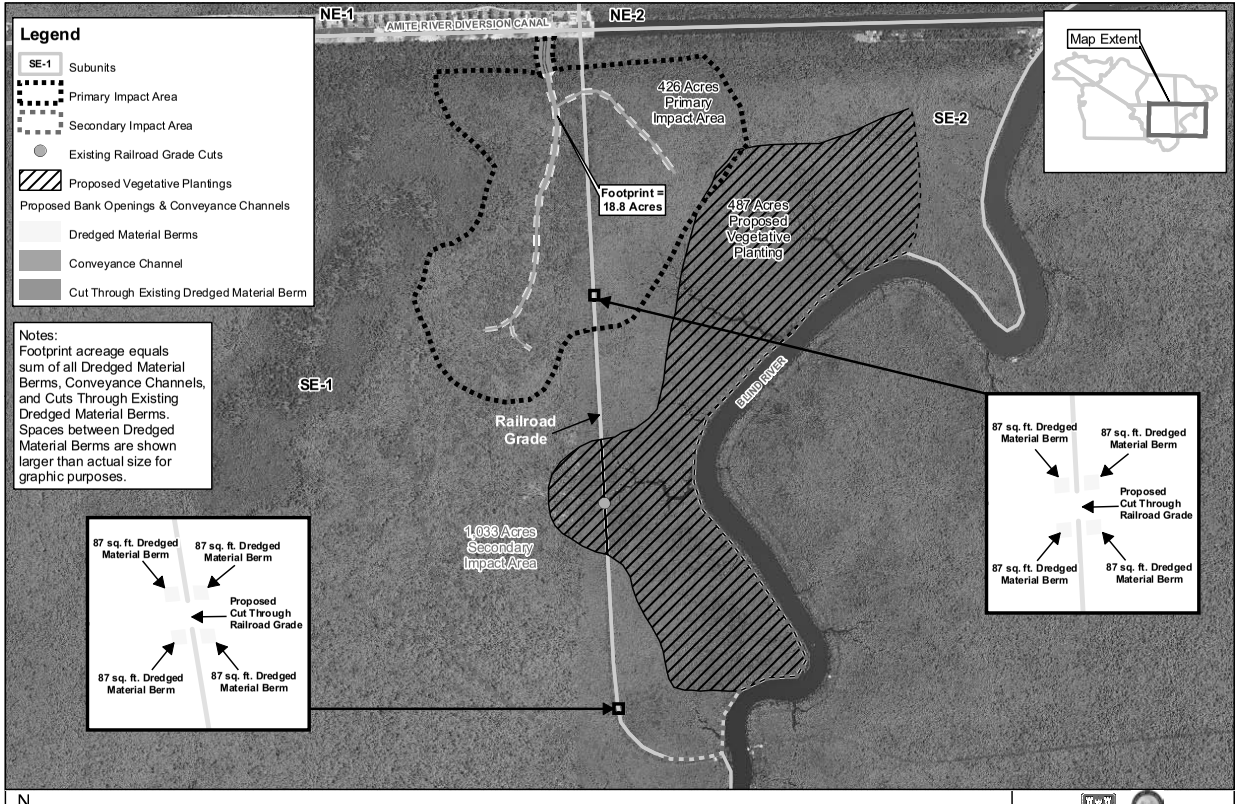
3.4.3 Alternative 34 (SE-1/SE-2)

Features of Alternative 34 (Figure 7) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
- Dredged material (2.7 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 2.7 acres of dredged material berm.
- Two cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles south of the ARDC. The second cut would be approximately 2.0 miles south of the ARDC.
- Vegetative plantings of freshwater swamp tree species within 487 acres of the swamp floor.

The opening in the south bank of the ARDC coupled with the two gaps in the railroad grade would facilitate hydrologic connectivity between the ARDC, SE-1, and SE-2. These openings would promote an influx of fresh water, nutrients, and sediments into these areas, which would help flush high salinity waters from the swamp, restore the degraded swamp habitat, and reverse the transition to marsh and open water. Alternative 34 would benefit approximately 1,459 acres of existing freshwater swamp, recreate 146 acres of freshwater swamp from freshwater marsh, and create 2.7 acres of upland habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 1 gives specific quantities and areas associated with the construction of the final array of alternatives. Table 2 summarizes the features associated with each alternative within the final array.


Legend
SE-1
Subunits
Primary Impact Area
Secondary Impact Area
Existing Railroad Grade Cuts
Proposed Vegetative Plantings
Proposed Bank Openings & Conveyance Channels
Dredged Material Berms
Conveyance Channel
Cut Through Existing Dredged Material Berm
Notes:
Footprint acreage equals sum of all Dredged Material Berms, Conveyance Channels, and Cuts Through Existing Dredged Material Berms. Spaces between Dredged Material Berms are shown larger than actual size for graphic purposes.
NE-1
AMITE RIVER DIVERSION CANAL
NE-2
SE-1
SE-2
426 Acres Primary Impact Area
Footprint = 18.8 Acres
487 Acres Proposed Vegetative Planting
Railroad Grade
1,038 Acres Secondary Impact Area
BLIND RIVER
Map Extent
87 sq. ft. Dredged Material Berm
Proposed Cut Through Railroad Grade
N
0
1,000
2,000
3,000
Feet
ALTERNATIVE 34
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 7
Date: December 2009
Scale: 1:24,000
Source: USGS/GEC
Map ID: 27850108-1869

3.4.4 Alternative 35 (SE-1)

Features of Alternative 35 (Figure 8) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (2.2 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 2.2 acres of the dredged material berms.

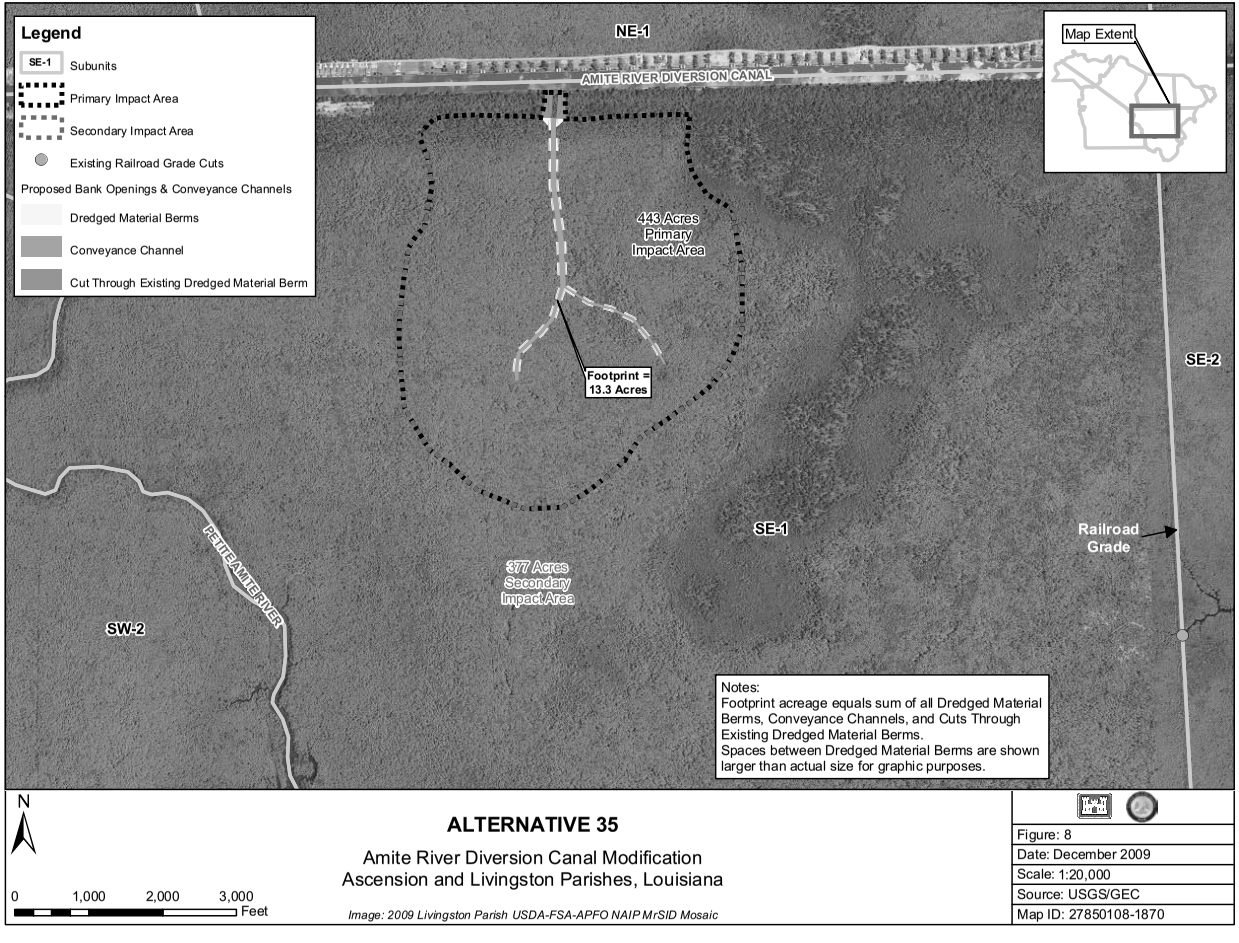
The opening would promote an influx of fresh water, nutrients, and sediments into these areas, which would help flush high salinity waters from the swamp, improve the degraded swamp habitat, and decrease the transition to marsh and open water. Alternative 35 would benefit approximately 820 acres of existing freshwater swamp and create 2.2 acres of upland habitat from dredged material placement.

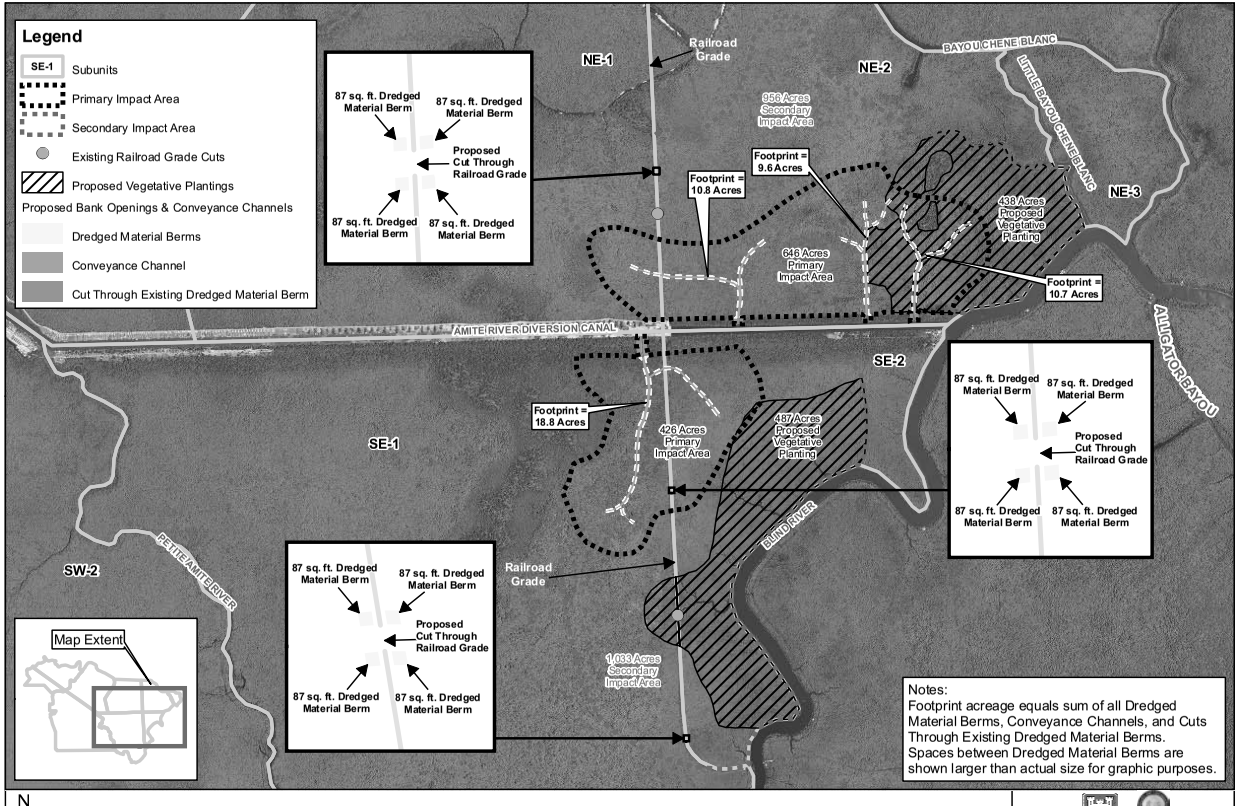
All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 1 gives specific quantities and areas associated with the construction of the final array of alternatives. Table 2 summarizes the features associated with each alternative within the final array.

3.4.5 Alternative 36 (NE-1/NE-2, SE-1/SE-2)

Features of Alternative 36 (Figure 9) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2, and the ARDC.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.


Legend
SE-1 Subunits
Primary Impact Area
Secondary Impact Area
Existing Railroad Grade Cuts
Proposed Bank Openings & Conveyance Channels
Dredged Material Berms
Conveyance Channel
Cut Through Existing Dredged Material Berm
NE-1
AMITE RIVER DIVERSION CANAL
Map Extent
443 Acres Primary Impact Area
Footprint = 13.3 Acres
SE-2
SE-1
377 Acres Secondary Impact Area
Railroad Grade
AMITE RIVER
SW-2
Notes:
Footprint acreage equals sum of all Dredged Material Berms, Conveyance Channels, and Cuts Through Existing Dredged Material Berms.
Spaces between Dredged Material Berms are shown larger than actual size for graphic purposes.
N
0 1,000 2,000 3,000 Feet
ALTERNATIVE 35
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 8
Date: December 2009
Scale: 1:20,000
Source: USGS/GEC
Map ID: 27850108-1870



ALTERNATIVE 36

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 9
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1871

- Dredged material (7.8 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately 2 miles south of the ARDC.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 7.8 acres of the dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 925 acres of the swamp floor.

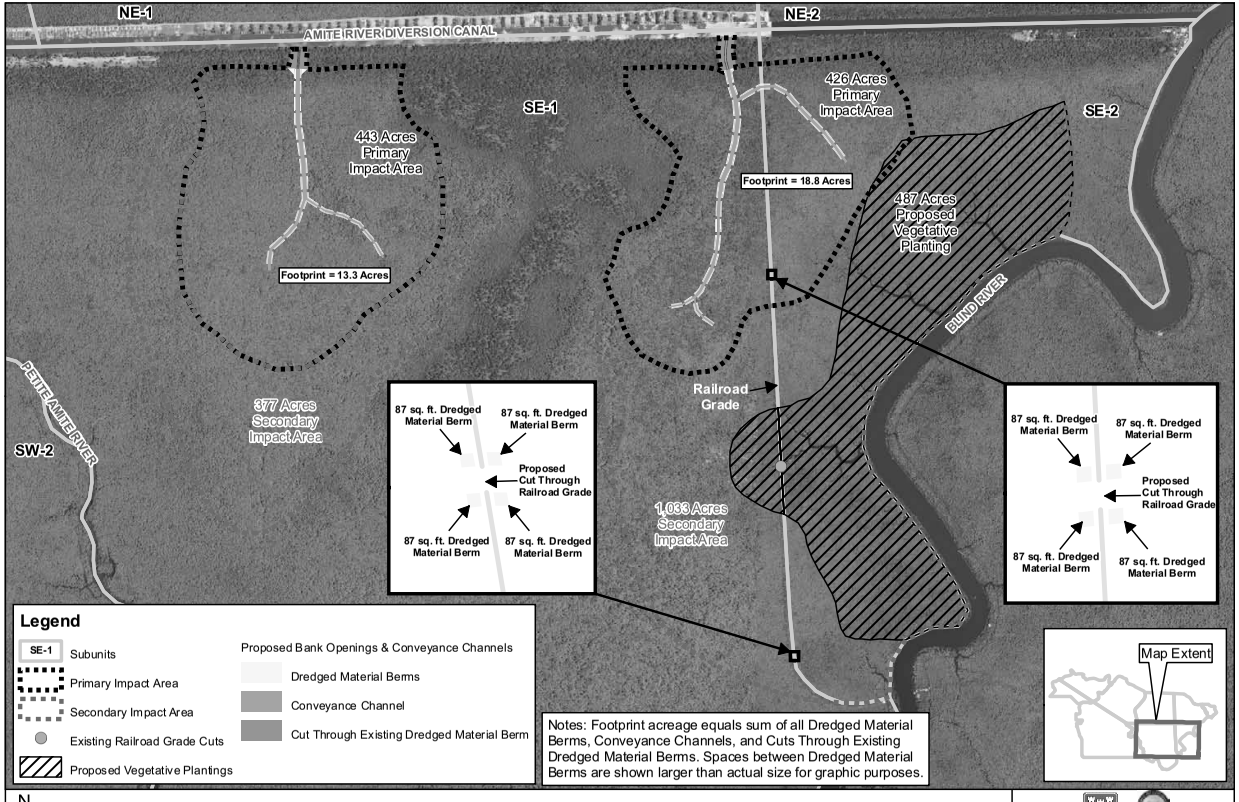
The openings would restore hydrologic connectivity of the habitats north and south of the ARDC with the ARDC. North of the ARDC, proper drainage of impounded waters in NE-2 would promote the restoration of the degraded swamp and the decreasing of marsh to swamp forest. South of the ARDC, the swamp habitats would benefit from the influx of fresh water, nutrients, and sediments. Alternative 36 would benefit approximately 3,061 acres of existing freshwater swamp, recreate 290 acres of freshwater swamp from freshwater marsh, and create 7.8 acres of upland habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 1 gives specific quantities and areas associated with the construction of the final array of alternatives. Table 2 summarizes the features associated with each alternative within the final array.

3.4.6 Alternative 37 (SE-1/SE-2, SE-1)

Features of Alternative 37 (Figure 10) include:

- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.
- One bank opening and conveyance channel in the south bank of the ARDC in SE-1.


NE-1
AMITE RIVER DIVERSION CANAL
NE-2
SE-1
SE-2
443 Acres Primary Impact Area
Footprint = 13.3 Acres
426 Acres Primary Impact Area
Footprint = 18.8 Acres
487 Acres Proposed Vegetative Planting
BLIND RIVER
PETITE AMITE RIVER
SW-2
377 Acres Secondary Impact Area
Railroad Grade
1,033 Acres Secondary Impact Area
87 sq. ft. Dredged Material Berm
Proposed Cut Through Railroad Grade
Legend
SE-1 Subunits
Primary Impact Area
Secondary Impact Area
Existing Railroad Grade Cuts
Proposed Vegetative Plantings
Proposed Bank Openings & Conveyance Channels
Dredged Material Berms
Conveyance Channel
Cut Through Existing Dredged Material Berm
Notes: Footprint acreage equals sum of all Dredged Material Berms, Conveyance Channels, and Cuts Through Existing Dredged Material Berms. Spaces between Dredged Material Berms are shown larger than actual size for graphic purposes.
Map Extent
N
0 1,000 2,000 3,000 Feet
ALTERNATIVE 37
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 10
Date: February 2010
Scale: 1:26,000
Source: USGS/GEC
Map ID: 27850108-1872

- Two cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles south of the ARDC. The second cut would be approximately 2.0 miles south of the ARDC.
- Dredged material (4.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 4.9 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 487 acres of the swamp floor.

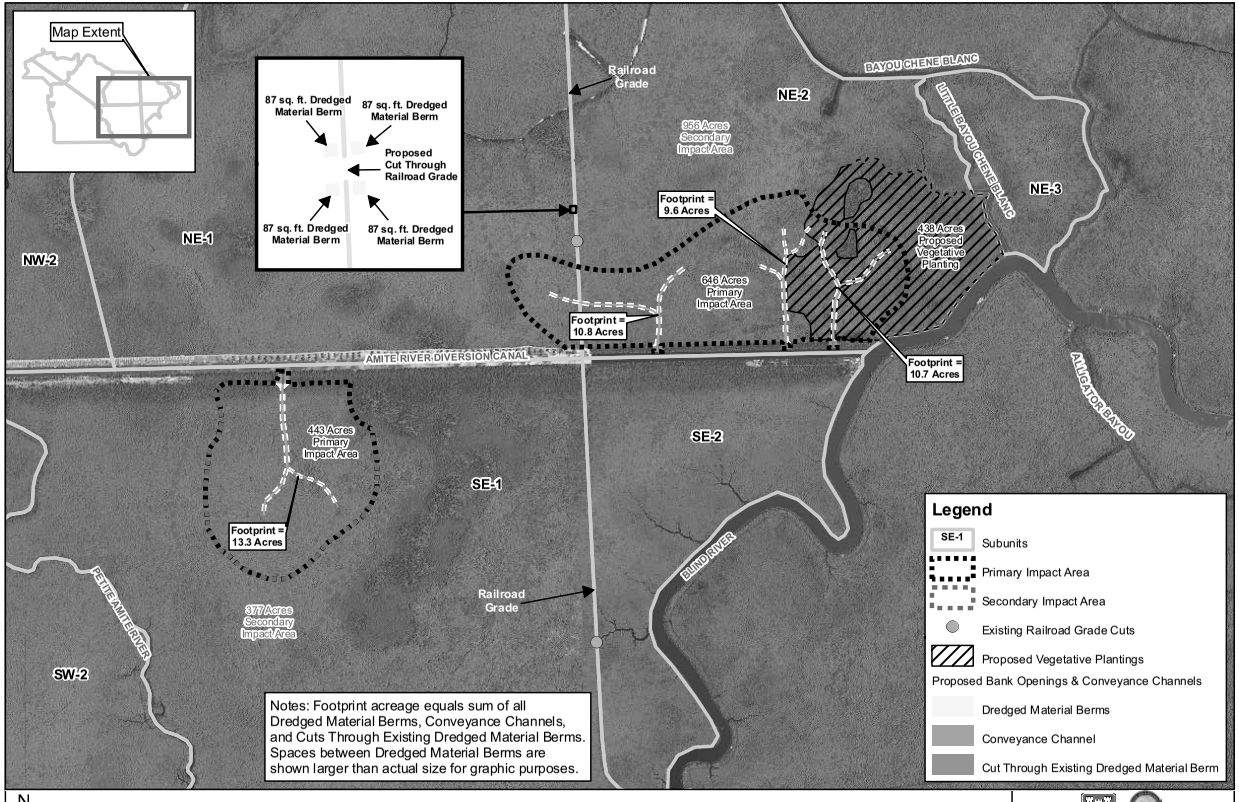
The openings would restore hydrologic connectivity of the area south of the ARDC with the ARDC. Subunits SE-1 and SE-2 would benefit from the influx of fresh water, nutrients, and sediments. This would maintain the swamp forests in SE-1 and improve the degraded swamp forest in the eastern portion of SE-1 and in SE-2, as well as decrease the transition from swamp to marsh to ultimately open water in SE-2. Alternative 37 would benefit approximately 2,279 acres of existing freshwater swamp, recreate 146 acres of freshwater swamp from freshwater marsh, and create 4.9 acres of upland habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp.

3.4.7 Alternative 38 (NE-1/NE-2, SE-1)

Features of Alternative 38 (Figure 11) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One bank opening and conveyance channel in the south bank of the ARDC in SE-1.
- One cut would be created in the railroad grade approximately 0.9 miles north of the ARDC to improve sheet flow.


Map Extent
87 sq. ft. Dredged Material Berm
87 sq. ft. Dredged Material Berm
Proposed Cut Through Railroad Grade
87 sq. ft. Dredged Material Berm
87 sq. ft. Dredged Material Berm
Railroad Grade
BAYOU CHENE BLANC
LITTLE BAYOU CHENE BLANC
NE-2
NE-3
NE-1
NW-2
966 Acres Secondary Impact Area
Footprint = 9.6 Acres
438 Acres Proposed Vegetative Planting
646 Acres Primary Impact Area
Footprint = 10.8 Acres
Footprint = 10.7 Acres
AMITE RIVER DIVERSION CANAL
ALLIGATOR BAYOU
443 Acres Primary Impact Area
SE-2
SE-1
Footprint = 13.3 Acres
BLIND RIVER
Railroad Grade
PETITE AMITE RIVER
377 Acres Secondary Impact Area
SW-2
Notes: Footprint acreage equals sum of all Dredged Material Berms, Conveyance Channels, and Cuts Through Existing Dredged Material Berms. Spaces between Dredged Material Berms are shown larger than actual size for graphic purposes.
Legend
SE-1 Subunits
Primary Impact Area
Secondary Impact Area
Existing Railroad Grade Cuts
Proposed Vegetative Plantings
Proposed Bank Openings & Conveyance Channels
Dredged Material Berms
Conveyance Channel
Cut Through Existing Dredged Material Berm
N
0 2,000 4,000 6,000 Feet
ALTERNATIVE 38
Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana
Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic
Figure: 11
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1873

- Dredged material (7.2 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Vegetative plantings of bottomland hardwood/freshwater swamp tree species on 7.2 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 438 acres of the swamp floor.

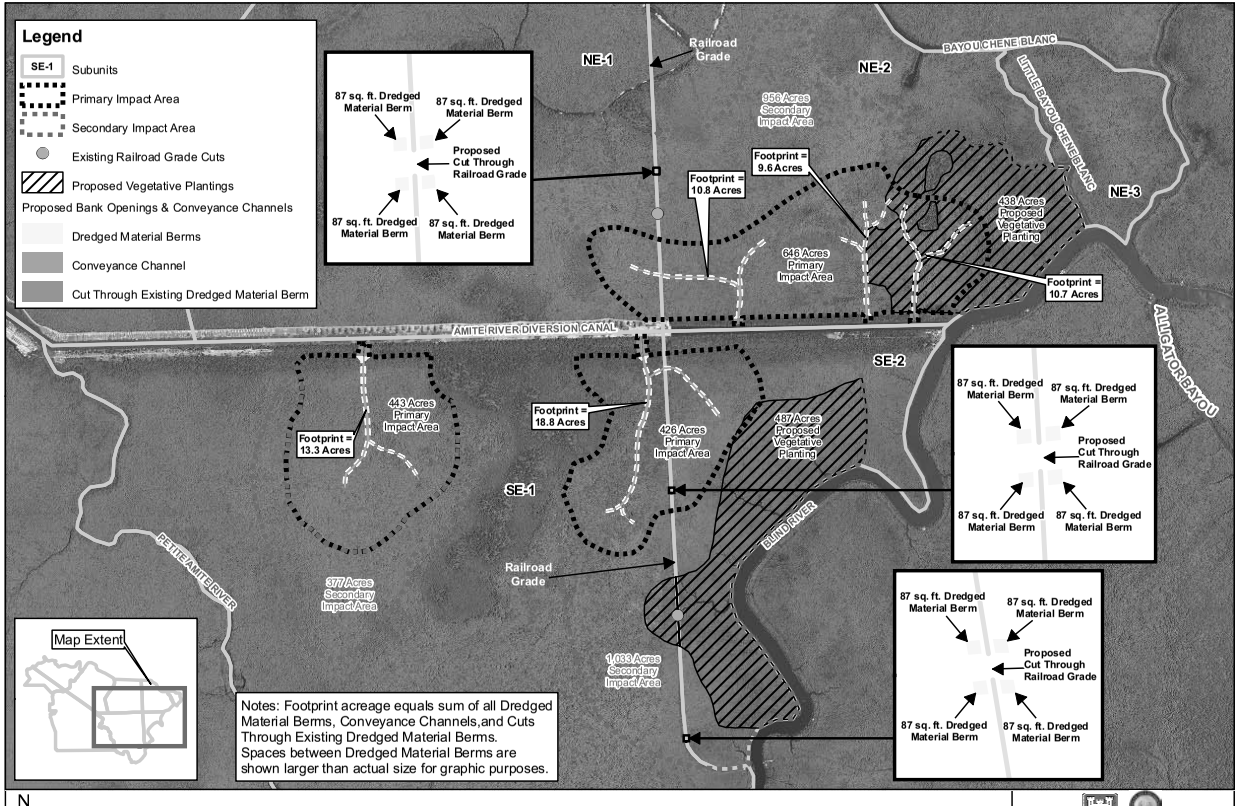
Implementation of this alternative would restore the hydrologic connectivity of NE-1, NE-2, and SE-1 with the ARDC. Within NE-1 and NE-2, the benefits would consist of proper drainage of impounded waters from NE-2, improvement of the degraded swamp, and decreasing the transition from swamp to march to ultimately open water. The cut in the south bank of ARDC would restore the hydrologic connectivity of the ARDC with SE-1 and help to maintain the health of the swamp forest along the western portion of SE-1. Alternative 38 would benefit approximately 2,422 acres of existing freshwater swamp, recreate 144 acres of freshwater swamp from freshwater marsh, and create 7.2 acres of upland habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 1 gives specific quantities and areas associated with the construction of the final array of alternatives. Table 2 summarizes the features associated with each alternative within the final array.

3.4.8 Alternative 39 (NER) (NE-1/NE-2, SE-1/SE-2 – All Subunits Combined)

Features of Alternative 39 (Figure 12) include:

- Three dredged material bank openings and three bifurcated conveyance channels in the north bank of the ARDC in NE-2 with the westernmost cut in the north bank of the ARDC also extending through the railroad grade into NE-1 to add connectivity between NE-1 and NE-2.
- One dredged material bank opening and one bifurcated conveyance channel in the south bank of the ARDC in SE-1 with the conveyance channel extending through the railroad grade into SE-1 to add connectivity between SE-1 and SE-2, and the ARDC.



ALTERNATIVE 39

Amite River Diversion Canal Modification
Ascension and Livingston Parishes, Louisiana

Image: 2009 Livingston Parish USDA-FSA-APFO NAIP MrSID Mosaic

Figure: 12
Date: February 2010
Scale: 1:40,000
Source: USGS/GEC
Map ID: 27850108-1874

- One opening and one conveyance channel in the south bank of the ARDC in SE-1.
- Dredged material (9.9 acres) from the bank openings and the conveyance channel would be sidecast on both sides of the proposed channel. Gaps will be left in the disposal berms so sheet flow is not reduced.
- Three cuts would be created in the railroad grade to improve sheet flow. One cut would be approximately 0.9 miles north of the ARDC. The second cut would be approximately 0.9 miles south of the ARDC. The third cut would be approximately 2 miles south of the ARDC.
- Vegetative plantings of bottomland hardwood / freshwater swamp tree species on 9.9 acres of dredged material berms.
- Vegetative plantings of freshwater swamp tree species within 925 acres of the swamp floor.

Implementation of this alternative would restore the hydrologic connectivity between NE-1, NE-2, SE-1, and SE-2 with the ARDC. This alternative would provide the maximum effort to restore hydrologic connectivity of the wetlands to the ARDC. Alternative 39 would benefit approximately 3,881 acres of existing freshwater swamp, recreate 290 acres of freshwater swamp from freshwater marsh, and create 9.9 acres of upland habitat from dredged material placement.

All excavation to take place for the cuts through the dredged material berms as well as the conveyance channels through the swamp would be based on four design cross-sections (Figures 2 through 5). These cross-sections were developed in an effort to mimic natural, existing cuts within the study area, which have been determined to be self-maintaining. The cross-sections include a 70-foot wide cut section with benches, a 70-foot wide cut section, a 50-foot wide cut section and a 30-foot wide cut section. The 70-foot cut section with benches is designed to allow increased amounts of flow to pass beyond the existing dredged material berm during high-water events. The material dredged from the existing berms would be placed along the swamp-side of the excavated cut as new bottomland hardwood habitat. All material dredged during construction of the conveyance channels would be placed along the channels, with gaps included, to allow sufficient sheet flow to be conveyed from the swamp. Table 1 gives specific quantities and areas associated with the construction of the final array of alternatives. Table 2 summarizes the features associated with each alternative within the final array.

3.5 COMPARISON OF ALTERNATIVE PLANS

Of the seven alternatives that make up the final array, three are individual alternatives, while the other four are combinations of these three. The effects of the alternatives within the final array were evaluated against the Future Without Project (FWOP) Project condition (The No-Action Alternative) in order to determine their overall impact over the 50-year period of analysis. Alternatives were then compared to each other. This includes environmental impacts to significant resources, benefits, costs and contributions to project goals, planning objectives and constraints, contributions to the Federal objective, and the P&G's four evaluation criteria (completeness, effectiveness, efficiency and

acceptability). A comparison of the features included in each alternative within the final array is found in Table 2.

Table 2. Comparison of Final Array of Alternatives

Alternative	North Bank Openings	South Bank Openings	Railroad Grade Openings	Berm Plantings (Acres)	Swamp Plantings (Acres)
33	3	0	1	5.0	438
34	0	1	2	2.7	487
35	0	1	0	2.2	0
36	3	1	3	7.8	925
37	0	2	2	4.9	487
38	3	1	1	7.2	438
39	3	2	3	9.9	925

Section 7

DESIGN

Design Assumptions

In the process of developing preliminary designs of proposed alternative plans for the LCA ARDC Modification project, some design assumptions were made. First, it was assumed that if the cross sections for the proposed conveyance channels were to mimic the cross sectional makeup of relict cuts, found near Blind River, the proposed channels would maintain a hydrologic equilibrium by maintaining flow rates large enough to prevent the buildup of sediments within the channel over the lifespan of the project. Secondly, it was assumed that with a 3H:1V and 4H:1V slope and seeding and mulching, the slopes along the dredged material berm openings would remain stable. Two slope dimensions were specified for portions on the proposed conveyance channels, depending on the overall width of channel desired for each reach. The slope dimensions will be revised upon completion of a full geotechnical investigation and slope stability analysis, during the PED phase of the project. This is based on the assumption that the berm material is primarily composed of clay, allowing for increased slope stability. The alignment of the conveyance channels are based on preliminary data and LIDAR data. Once all pertinent information is gathered, such as geotechnical investigation and a full topographic survey, the final alignment and platform of the conveyance channels will be adjusted accordingly. This information will not be available until the Plans and Specifications phase of the project.

Erosion Control Requirements

In order to ensure that sediments do not leave the project area during construction, best management practices (BMPs) will be implemented. These BMPs include the use of silt fencing, hay bales and seeding and mulching in the appropriate locations.

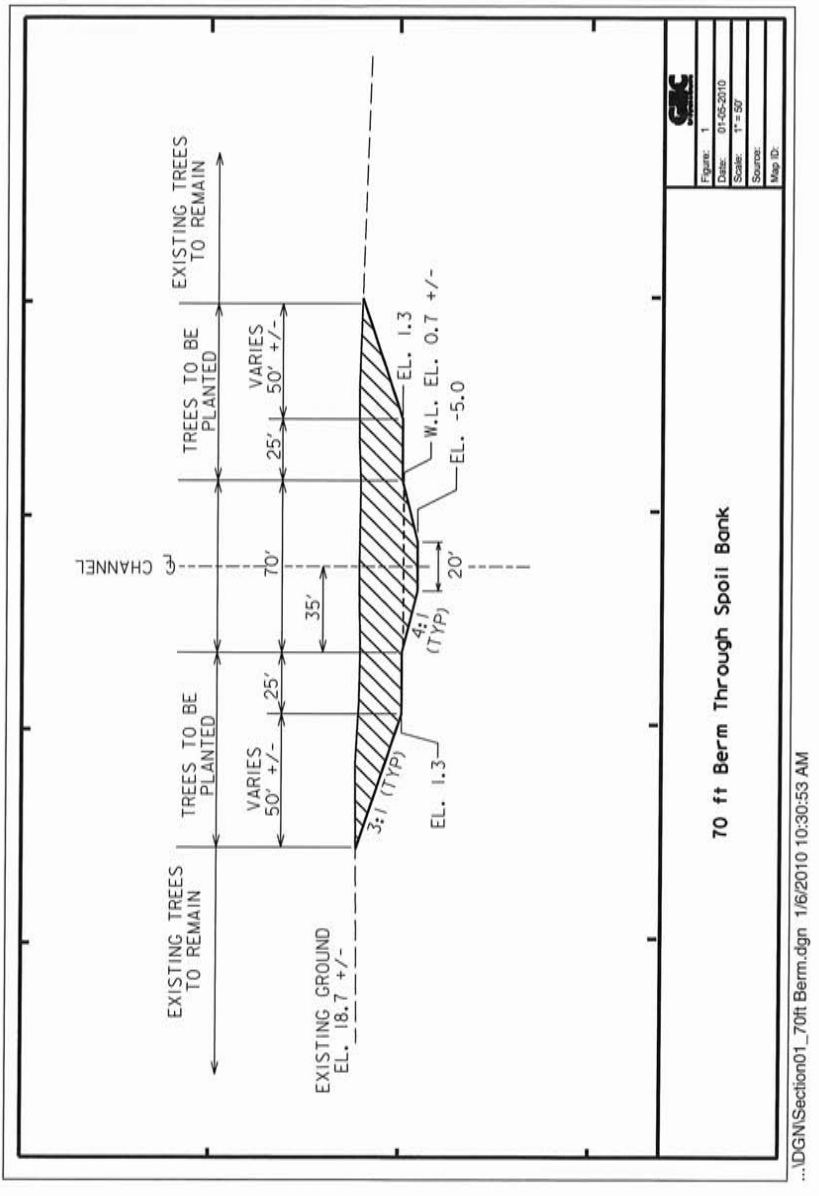
Silt fencing would be utilized along the perimeter of the construction footprint to trap free flowing sediment and hay bales would be placed in flow areas which tend to collect excessive amounts of sediments. Seeding and mulching would be used to minimize sediment runoff in the areas of cut on the existing ARDC spoil bank.

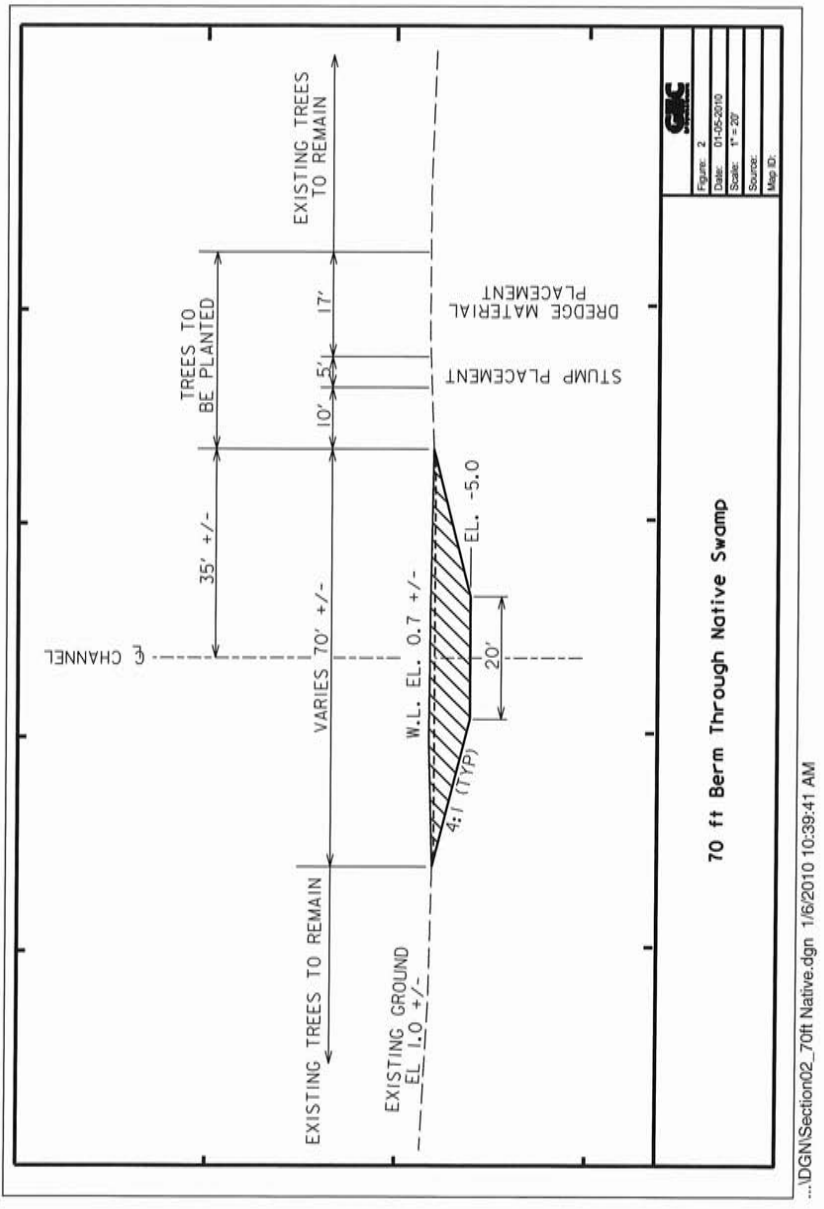
Preliminary cost estimates for the final array of alternatives included the use of these BMPs. During the plans and specifications phase of the project the quantities and layout for these implementations will be further determined.

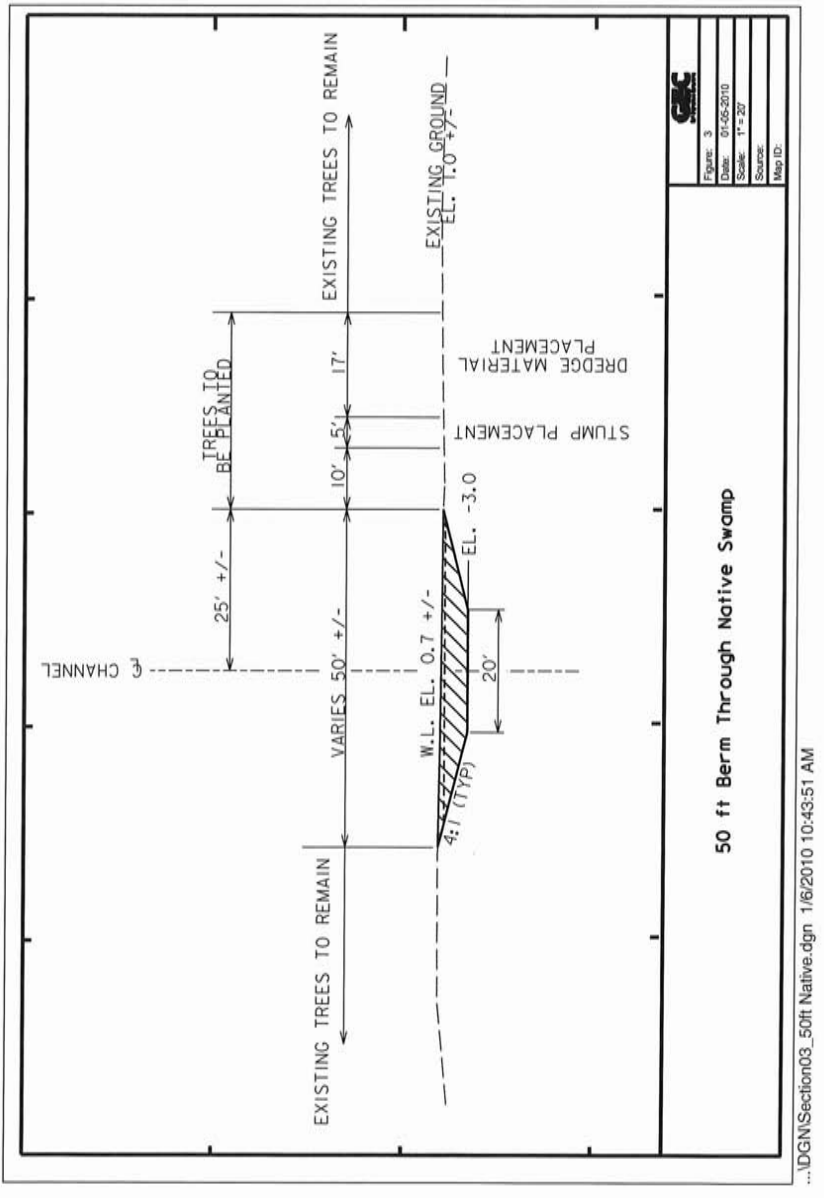
Design Cross Sections

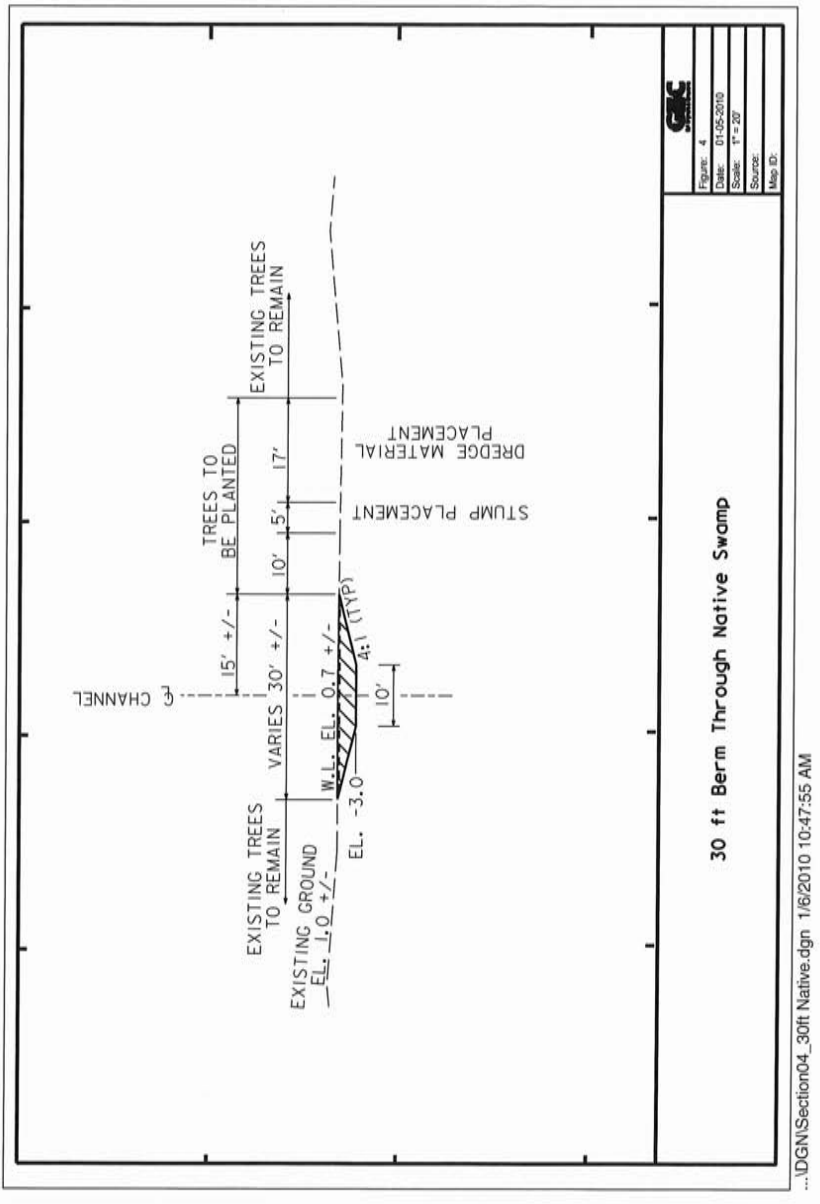
To scale cross sections depicting the proposed cuts through the dredged material berm and for the conveyance channels are found in Figures 1 through 4. Sections depicting the proposed Type 1 and Type 2 cuts through the existing railroad grade can be found in Figure 5.

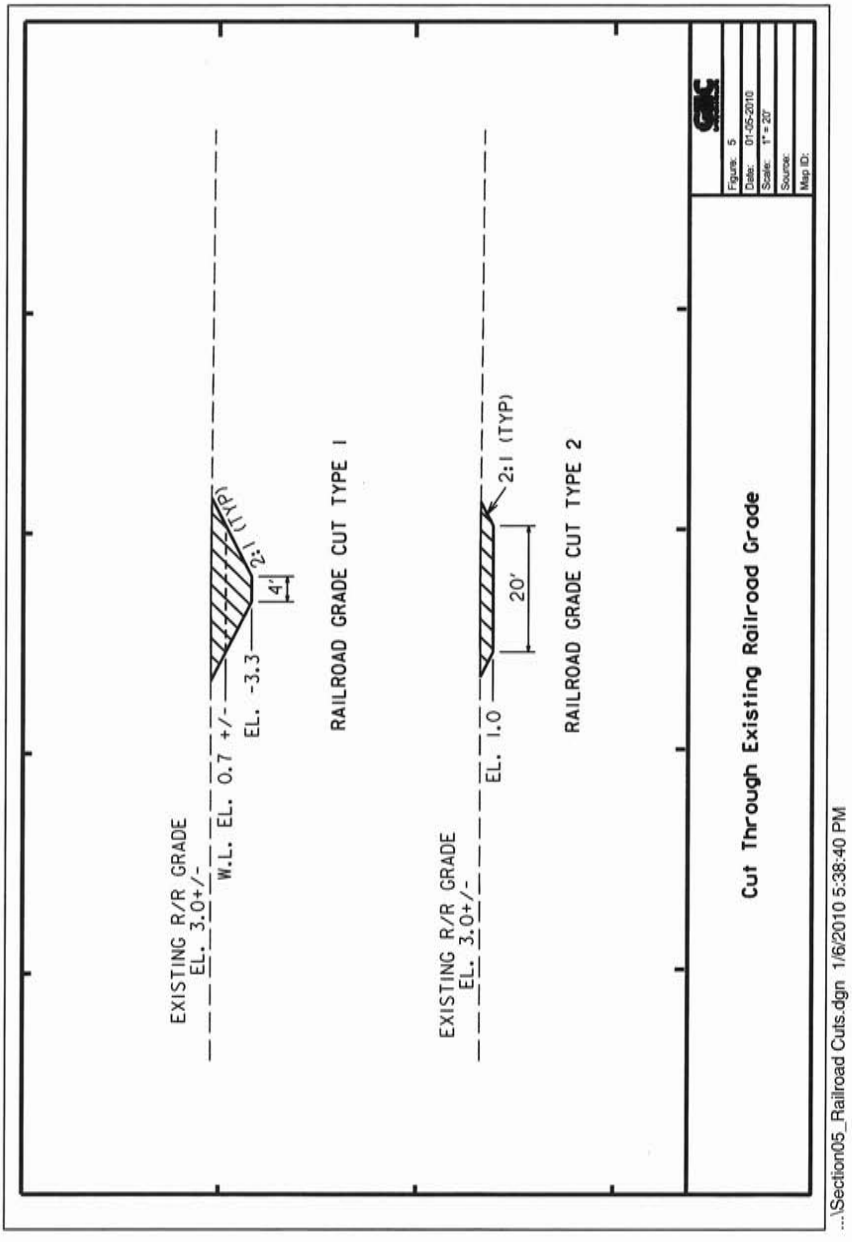
CROSS-SECTIONS

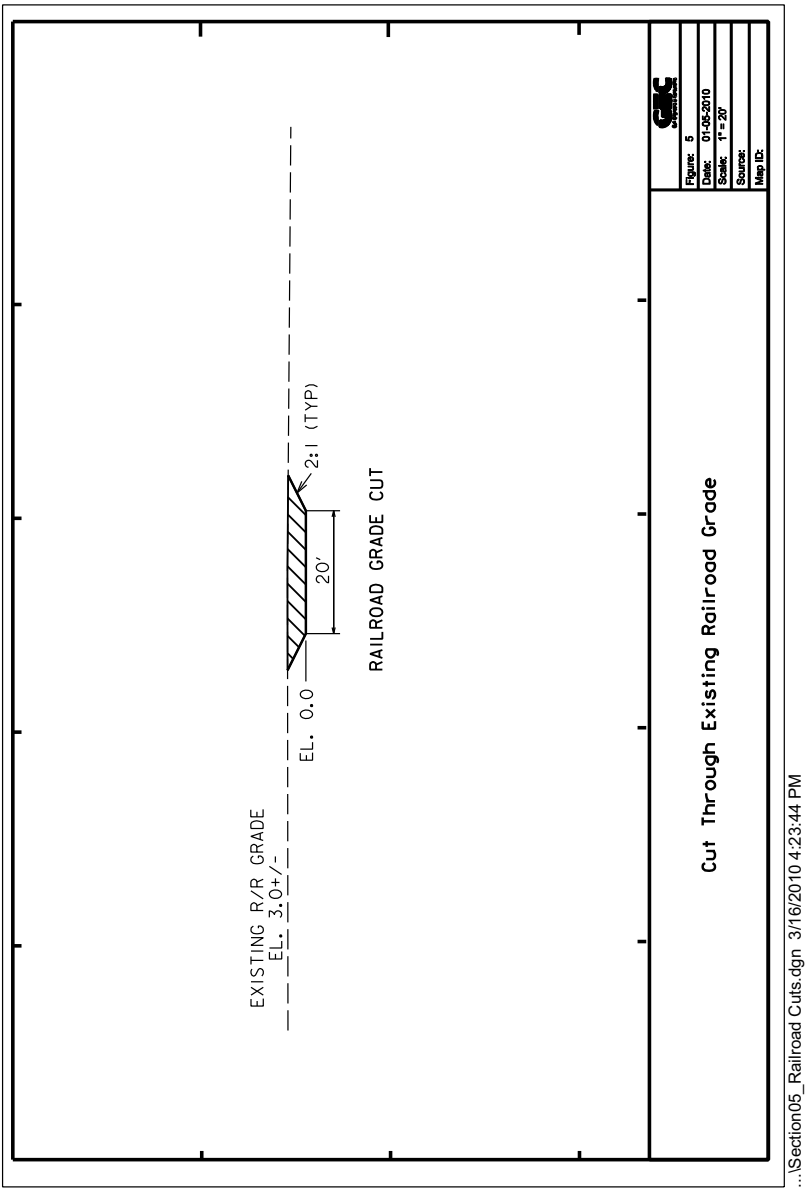

EXISTING TREES TO REMAIN
TREES TO BE PLANTED
VARIES 50' +/-
25'
70'
35'
CHANNEL
EXISTING GROUND EL. 18.7 +/-
3:1 (TYP)
EL. 1.3
4:1 (TYP)
20'
W.L. EL. 0.7 +/-
EL. -5.0
70 ft Berm Through Spoil Bank
Figure: 1
Date: 01-05-2010
Scale: 1" = 50'
Source:
Map ID:
...\DGN\Section01_70ft Berm.dgn 1/6/2010 10:30:53 AM


EXISTING TREES TO REMAIN
TREES TO BE PLANTED
35' +/-
10'
5'
17'
DREDGE MATERIAL PLACEMENT
STUMP PLACEMENT
℄ CHANNEL
VARIES 70' +/-
W.L. EL. 0.7 +/-
EL. -5.0
20'
4:1 (TYP)
EXISTING TREES TO REMAIN
EXISTING GROUND
EL 1.0 +/-
70 ft Berm Through Native Swamp
Figure: 2
Date: 01-05-2010
Scale: 1" = 20'
Source:
Map ID:
...\DGN\Section02_70ft Native.dgn 1/6/2010 10:39:41 AM


50 ft Berm Through Native Swamp
Figure: 3
Date: 01-05-2010
Scale: 1" = 25'
Source:
Map ID:
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EXISTING GROUND
EL. 1.0 +/-
TREES TO BE PLANTED
25' +/-
VARIES 50' +/-
10'
5'
17'
DREDGE MATERIAL PLACEMENT
STUMP PLACEMENT
EL. -3.0
W.L. EL. 0.7 +/-
4:1 (TYP)
20'
℄ CHANNEL
EXISTING TREES TO REMAIN
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CHANNEL
15' +/-
30' +/-
10'
5'
17'
TREES TO BE PLANTED
EXISTING TREES TO REMAIN
EXISTING TREES TO REMAIN
VARIES
W.L. EL. 0.7 +/-
4:1 (TYP)
STUMP PLACEMENT
DREDGE MATERIAL PLACEMENT
EXISTING GROUND EL. 1.0 +/-
EL. -3.0
10'
30 ft Berm Through Native Swamp
Figure: 4
Date: 01-05-2010
Scale: 1" = 20'
Source:
Map ID:
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EXISTING R/R GRADE
EL. 3.0+/-
W.L. EL. 0.7 +/-
EL. -3.3
2:1 (TYP)
4'
RAILROAD GRADE CUT TYPE 1
EXISTING R/R GRADE
EL. 3.0+/-
EL. 1.0
2:1 (TYP)
20'
RAILROAD GRADE CUT TYPE 2
Cut Through Existing Railroad Grade
Figure: 5
Date: 01-05-2010
Scale: 1" = 20'
Source:
Map ID:
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EXISTING R/R GRADE
EL. 3.0+/-
EL. 0.0
20'
2:1 (TYP)
RAILROAD GRADE CUT
Cut Through Existing Railroad Grade
Figure: 5
Date: 01-06-2010
Scale: 1" = 20'
Source:
Map ID:
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Section 8

CONSTRUCTION PROCEDURES

Construction Procedures

It is estimated that the earthmoving portion of construction for the recommended plan (Alternative 33) would take approximately six months. This duration includes the mobilization and demobilization of the required equipment and laborers, construction of all three cuts through dredged material berms and conveyance channels, one cut through existing railroad grade. The first implementation of vegetative plantings within the appropriate swamp and bottomland hardwood habitat will take approximately a year. A secondary implementation of vegetative plantings will be required at a later date, depending on the mortality rate of the first plantings. The second phase will last approximately a year as well.

Once the appropriate equipment is mobilized to the project site via trucks and barges, construction of the gaps through the dredged material berms would commence by clearing and grubbing the designated footprints of construction on the north side of the ARDC. Stumps are to be removed from the portions of excavation within the proposed channels, but only trees would be cleared along the benches, 10-foot buffers and dredged material and stump placement areas. Cleared trees would be placed in the same area with the stumps and dredged material. Once clearing is completed at one cut location the equipment would be mobilized to another cut location so excavation could begin.

Excavation of the cuts within the existing dredged material berms and the proposed conveyance channels would be carried out by two short-reach, amphibious excavators. As the equipment cuts its way into the cut locations, the dredged material would be placed on the sides of the cuts and conveyance channels with 50-foot gaps placed between the deposited material, every 300 feet. The excavated cuts and channels would serve as the area in which equipment would move in and out of the construction area.

Upon completion of the excavation, vegetative plantings would be carried out within the predetermined areas of the swamp and material placement. Approximately 173 trees per acre would be planted. Each area planted would consist of approximately 10 percent 1-gallon potted, 15 percent 3-gallon potted, and 75 percent bare-root seedlings. Cypress and tupelo gum would be planted within the swamp floor areas and hardwoods such as live oaks and sweet gum would be planted on both the newly created and existing dredged material berms. Nutria guards would be required on every tree planted in order to ensure a reasonable success rate. It is expected that the replanting of 50 percent of these areas would be necessary within a few years of the conclusion of cut and channel construction. No relocations of infrastructure or utilities would be required during construction of the Alternative 33 (TSP).

Section 9

OMRR&R

Operations, Maintenance, Repair, Replacement, and Rehabilitation

Operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) requirements for the Alternative 33 (TSP) include a yearly inspection of the cut locations and conveyance channels to ensure no flow interruption occurs, resulting from natural occurrences such as wind-blown debris or fallen trees. Upon inspection it would be determined if clearing and snagging or some other appropriate remedial operation is necessary to restore the required conveyance within the features of Alternative 33 (TSP).

It is understood that the conveyance channels would be naturally altered over time, eventually reaching a state of hydrologic equilibrium similar to the relict channels that the conveyance channels were designed to mimic. These changes would most possibly result in changes to the geomorphology of the channel along with a transition to a more meandering channel makeup and would not reduce the expected benefits of Alternative 33 (TSP). Therefore, it is anticipated that little to no attempt to maintain the depth or shoreline geometry of the conveyance channels would be necessary. The non-Federal sponsor would be required to enforce any restrictions as identified in the easements to ensure that the benefits of Alternative 33 (TSP) are retained. Table 1 shows a breakdown of the OMRR&R costs.

Table 1

Alternative	Inspection Cost (Annual)	Clearing and Snagging (Every 5 years)	
		Mobilization	Clearing and Snagging
33 (TSP)	$2,000	$20,000	$21,000
34	$2,000	$20,000	$7,000
35	$2,000	$20,000	$7,000
36	$2,000	$20,000	$28,000
37	$2,000	$20,000	$14,000
38	$2,000	$20,000	$28,000
39	$2,000	$20,000	$35,000

Operations and maintenance costs are assumed to last for the 50-year period of analysis.

Section 10

COST ESTIMATES

Cost Estimates for Final Array of Alternatives

The following cost estimates were developed during the planning process as a means of evaluating each restoration alternative and for use with the Institute for Water Resources (IWR) Planning Suite analysis. Table 1 lists the costs estimated for Alternatives 33 through 39 (Final Array). Table 1 shows a summary of the items associated with each cost estimate. Table 2 depicts the relationship between cost and benefits for the final array of alternatives. The detailed cost estimates for the final array of alternatives are found in the Cost Annex of this Appendix.

Table 1. Summary of Costs Estimates for the Final Array

Item	Alt. 33	Alt. 34	Alt. 35	Alt. 36	Alt. 37	Alt. 38	Alt. 39
Mob/Demob	$250,000	$150,000	$150,000	$300,000	$200,000	$300,000	$350,000
Earthwork	$462,000	$332,000	$262,000	$788,000	$583,000	$698,000	$1,050,000
Erosion Protection	$46,000	$23,000	$23,000	$69,000	$45,000	$69,000	$92,000
Vegetative Plantings	$819,000	$906,000	$6,000	$1,720,000	$909,000	$822,000	$1,730,000
Surveying	$54,000	$22,000	$22,000	$70,000	$70,000	$70,000	$86,000
Markups	$631,000	$564,000	$176,000	$1,152,000	$695,000	$756,000	$1,289,000
Planning Eng. & Design	$189,000	$169,000	$53,000	$346,000	$209,000	$227,000	$387,000
Construction Management	$110,000	$99,000	$31,000	$202,000	$122,000	$132,000	$226,000
Total Construction Costs	$2,560,000	$2,270,000	$720,000	$4,650,000	$2,830,000	$3,070,000	$5,210,000
(25% Contingency)	$640,000	$568,000	$180,000	$1,160,000	$708,000	$768,000	$1,300,000
Real Estate	$136,000	$144,000	$62,000	$259,000	$185,000	$178,000	$301,000
Total First Costs*	$3,340,000	$2,980,000	$962,000	$6,070,000	$3,720,000	$4,020,000	$6,810,000
Interest During Construction**	$440,000	$390,000	$126,000	$797,000	$489,000	$528,000	$894,000
Total Construction Cost	$3,780,000	3,370,000	$1,090,000	$6,870,000	$4,210,000	$4,550,000	$7,700,000
Annual OMRR&R Costs	$10,000	$7,000	$7,000	$11,000	$8,000	$11,000	$12,000
Average Annual Costs**	$197,000	$174,000	$61,000	$351,000	$217,000	$236,000	$394,000

***First Quarter 2010 Dollars**

**** Average annual costs were determined over the six-year construction period with a discount rate of 4.375%**

1282

Table 2. Costs and Benefits of the Final Array

Alternative	Acres of Benefit	AAHUs	Total Construction Cost	Annualized Cost*	Annualized Cost/AAHU
35*	820	334	$1,090,000	$61,000	$180
38*	2,422	1,013	$4,550,000	$236,000	$230
37	2,279	922	$4,210,000	$217,000	$240
39*	3,881	1,602	$7,700,000	$394,000	$250
36	3,061	1,268	$6,870,000	$352,000	$280
33	1,602	679	$3,780,000	$197,000	$290
34	1,459	589	$3,370,000	$174,000	$300

Cost Estimate Assumptions and Contingencies

Mobilization/Demobilization

It was assumed that a majority of the equipment used each day would be held at a temporary loading/unloading zone. Therefore, this equipment would be barged in and out on an as-needed basis. A base estimate of $150,000 was used for the Mobilization and Demobilization costs (One cut) with an extra $50,000 for each additional cut. A D-6 dozer, two amphibious short-reach excavators, and a log skidder will be hauled in via a truck and trailer. A barge, to be utilized for on-water work, will be brought in via a tug boat as well. The costs were determined from the 2008 MII costbook and included equipment and labor. A productivity of 100% was assumed for the Mob/Demob.

Earthwork

Cut Excavation

This is the amount of earthwork needed to dig through the dredged material berm and into the swamp for each alternative. The material will be removed by using a D-6 dozer and two amphibious sort-reach excavators. The short reach excavators have a reach of 30 feet in one direction and a 2.5 cubic yard bucket. The cycle time for these excavators is 120 cubic yards per hour. Short-reach excavators were chosen due to the larger buckets they provide. Once the dredged material berm and the interior swamp are cleared of trees and brush, both excavators will dig their way into the construction area. The excavated material will be placed on both sides of the new cut and conveyance channels. Gaps of approximately 50 feet in width will be placed throughout the material placement areas to ensure that hydrologic flow is maintained throughout the area. The unit cost was obtained by using the equipment's cycle times and calculating the duration required for creating the proposed cuts and conveyance channels. It was assumed that an 80% productivity level would be achieved during this portion of construction. To accommodate the superintendent over a six month period an added sustenance cost of $6,720 will be included to the MCACES estimate (6 months x 4 weeks x 5 days x $56

per day). The per diem rate of $56.00 per day for Baton Rouge, LA. was used. The quantity was determined by GIS and cross-sections. The unit cost was calculated to be $3.41 per cubic yard of material excavated.

Clearing & Grubbing

This cost included the clearing of all brush/trees and the removal of stumps within the project footprint before excavation begins. Only the channel portions of the excavation through the existing dredged material berms and the swamp floor would require full clearing and grubbing, however the entire area was used for calculation of this cost item to account for the brush removal and any additional cutting of trees into smaller lengths. The stumps within the areas designated for material placement would not be removed. The removed trees will be placed within the surrounding swamp along the conveyance channels in a manner which ensures hydrologic flow remains. The stumps removed from the newly-excavated conveyance channels will be placed along the spoil placement areas. The unit cost was taken from the MII costbook for 2008. The area to be cleared was derived from GIS analysis.

Tree Removal

Tree Removal would take place along the footprint of all excavated channels, areas designated for material placement and the associated 10-foot gaps. Tree removal would also take place along the benches to be created within the existing dredged material berms. All stumps outside the channel would remain or be covered with the dredged material. The unit cost was taken from the MII costbook for 2008. The area to be cleared was derived from GIS analysis.

Erosion Protection

Seeding & Mulching

This price includes the seeding & mulching of the cut through the existing dredged material berms along the ARDC. The area to be seeded was determined by GIS analysis. The unit price was taken from the MII 2008 costbook.

Fertilizer

All areas to be seeded were determined to need fertilizer. It was estimated that each existing spoil bank cut would need approximately ten 50-pound bags of fertilizer for fertilization of the slopes. The unit price was taken from the MII 2008 costbook.

Temporary Silt Fencing

Silt fencing would be used to stop sediment form leaving the construction site in the areas surrounding the cut through the existing dredged material berms. Based on GIS analysis it was determined that approximately 1,000 feet was needed for each cut. The unit price was taken from the MII 2008 costbook.

Temporary Hay or Straw Bales

Hay bales would be used to control erosion or the loss of sediment in the low-lying areas for proposed cuts through the existing dredged material berms. It was estimated that 50 bales were needed for each cut. The unit price was taken from the MII 2008 costbook.

Vegetative Plantings

Trees (Dredged Material Berms)

A cost of $10.00 per 3-gallon potted seedlings and a cost of $4.00 per 1-gallon potted seedling were assumed. A unit price of $0.15 per bare-root seedling was assumed. It was determined that an initial planting would consist of 15 percent 1-gallon potted seedlings and 10 percent 3-gallon potted seedlings. Also included in the primary planting were 75 percent bare-root seedlings. A secondary planting of numbers totaling 50 percent of the primary planting was assumed. When planting 173 trees per acre (Including secondary planting), 26 would be 1- gallon potted, 17 would be 3-gallon potted, and 124 would be bare-root seedlings. This equates to a per acre cost of $295. The area was determined through GIS analysis.

Trees (Swamp Floor)

A cost of $10.00 per 3-gallon potted seedlings and a cost of $4.00 per 1-gallon potted seedling were assumed. A unit price of $0.15 per bare-root seedling was assumed. It was determined that an initial planting would consist of 15 percent 1-gallon potted seedlings and 10 percent 3-gallon potted seedlings. Also included in the primary planting were 75 percent bare-root seedlings. A secondary planting of numbers totaling 50 percent of the primary planting was assumed. When planting 173 trees per acre (Including secondary planting), 26 would be 1- gallon potted, 17 would be 3-gallon potted, and 124 would be bare-root seedlings. This equates to a per acre cost of $295. The area was determined through GIS analysis.

Nutria Control/Labor

Nutria control is to be implemented for all vegetative planting within the swamp and on the dredged material berms. Nutria control, including installation and planting labor for all seedlings, would be implemented at a cost of $9.00 per seedling for all plantings and each type (Swamp/Berms). This equates to a per acre cost of $1,553.

Contingency

A 25% contingency was applied to the total construction cost to take into account unforeseen issues that may arise during construction. The contingency was added as a baseline for planning purposes as was the previous policy for developing preliminary costs estimates. Because the contingency was applied consistently to all alternatives this would not affect the CE/ICA analysis. A cost risk analysis was conducted before the feasibility phase is completed to determine the true contingency required (59%). This 59% contingency was utilized for the MCACES estimated on the NER and TSP. A cost contingency was not applied to the monitoring costs, resulting in an overall contingency of 31 % for the project.

Final Design & Construction

Planning, Engineering and Design (PED)

It was assumed that the PED costs would be approximately 12% of the total project construction cost.

Construction Management (CM)

It was assumed that the CM costs would be approximately 7% of the total project construction cost for the preliminary cost estimates.

Real Estate

Real Estate Costs were provided based on the project footprints and easement requirements. Because this cost is not normally included in the total construction costs, a separate 25% contingency was applied.

Annualized Costs

This cost was determined by an economist at GEC. The current interest rate of 4.375% was applied over a one year construction period to determine the appropriate annualized cost.

Monitoring Costs

The estimated cost for the monitoring program is $2,971,200 for the first 10 years following the completion of project construction. The details behind the Adaptive Management and Monitoring costs are located in Appendix I.

Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) Costs

The OMRR&R costs would include yearly inspections and clearing & snagging costs for the channels when needed. It is assumed that the channels would require clearing and

snagging every five years. A yearly inspection cost of $1000 per day for two days is assumed each year ($2000 a year). In order to clear & snag an amphibious excavator would be needed at $350 per hour, including labor. It is assumed that clearing & snagging would take 20 hours per cut. An additional mobilization and demobilization of $20,000 is included as well.

MCACES Assumptions and Contingencies

In order to obtain a more thorough analysis of the costs associated with the recommended plan, a Micro-Computer Aided Cost Estimating System (MCACES) cost estimate was conducted on the recommended plan. Table 4 presents the Total Project Cost Summary Sheet for the MCACES estimate for the Tentatively Selected Plan (Alternative 33). This estimate included all items previously listed in the cost estimates for the final array, with the addition of various project-specific considerations such as contingencies and localized cost items such as sales tax and labor rates. Most items listed in the MCACES report were obtained from the 2008 English Costbook. Additional user defined costs were also provided for items not found in the Costbook. These items include:

- Earthmoving
- Crew Boat Costs
- Tug Boat Rental
- Vegetative Plantings

All labor costs were adjusted to match current costs in Livingston Parish, Louisiana. A contingency of 59% was determined based on a risk analysis as shown in this Appendix. The costs for construction were escalated to 2011 dollars as shown in Table 4. The overall cost of the recommended plan was estimated to be $8,540,000. The full MCACES report is found in the Cost Annex of this Appendix.

Table 3. Cost Apportionment for the Tentatively Selected Plan

Item	Federal	Non-Federal	Total
Construction	$2,890,000	$1,560,000	$4,450,000
S&A	$261,000	$140,000	$401,000
PED	$347,000	$187,000	$534,000
LERDDs	$117,000	$63,000	$180,000
Monitoring	$1,930,000	$1,040,000	$2,970,000
Total*	$5,550,000	$2,990,000	$8,540,000

S&A – Supervision and Administration (Construction Management)
PED – Planning, Engineering, and Design
LERRD – Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas
* Costs include escalation in 2010 Dollars and Contingencies.

Total Project Cost Summary

Project	LCA Amite River Diversion Canal Modification	District	MVN	Date	21-Jul-10
Location:	Livingston Parish, LA	POC	Puls, Jonathan	Page	1 of 1
Document	The project cost reflects the scope and schedule in the NEPA report.				
Contract	Total of TSP, Alternative 33				

Program Year (Budget EC): 2011
Effective Price Level Date: 1 Jan 10

WBS Number	Civil Works Feature & Sub-Feature Description	Effective Price level-Unit Price Estimate Cost $K	Cntg %	Cntg $K	Total $K	Esc %	FULLY FUNDED PROJECT ESTIMATE Cost $K	Cntg $K	Total $K	Mid Pt Date	Esc %	Cost $K	Cntg $K	Total $K
9	CHANNELS & CANALS	$ 2,591	59%	$ 1,529	$ 4,120	1.0%	$ 2,618	$ 1,544	$ 4,162	Apr-15	8.1%	$ 2,801	$ 1,653	$ 4,453
06	FISH AND WILDLIFE	$ 2,971	0%	$ -	$ 2,971	0.0%	$ 2,971	$ -	$ 2,971		0.0%	$ 2,971	$ -	$ 2,971
	CONSTRUCTION ESTIMATE TOTALS:	$ 5,562		$ 1,529	$ 7,091	1.0%	$ 5,589	$ 1,544	$ 7,133	Apr-15	8.1%	$ 5,772	$ 1,653	$ 7,425
01	LANDS AND DAMAGES	$ 113	59%	$ 67	$ 180	0.0%	$ 113	$ 67	$ 180	Sep-12	0.0%	$ 113	$ 67	$ 180
30	PLANNING, ENGINEERING & DESIGN	$ 311	59%	$ 183	$ 494	1.0%	$ 314	$ 185	$ 499	Apr-15	8.1%	$ 336	$ 198	$ 534
31	CONSTRUCTION MANAGEMENT	$ 233	59%	$ 138	$ 371	1.0%	$ 236	$ 139	$ 374	Apr-15	8.1%	$ 252	$ 149	$ 401
	PROJECT COST TOTALS:	$ 6,219	31%	$ 1,916	$ 8,136	0.6%	$ 6,251	$ 1,935	$ 8,187		4.1%	$ 6,473	$ 2,066	$ 8,539

Project Manager

Chief Cost Engineer

ESTIMATED FEDERAL COST:	5,551
ESTIMATED NON-FEDERAL COST:	2,989
ESTIMATED TOTAL PROJECT COST:	**8,539**

Cost Risk Analysis

In an effort to identify the applicable cost and schedule risks inherent with implementation of the TSP (Alternative 33), much of the process found within the USACE guidance was utilized. Once all potential areas of risk were agreed upon by the evaluation team, a Risk Register was created to help qualify and quantify the potential impacts of these risks. A Monte Carlo simulation was run on the registry, which yielded the applicable cost contingency to use for estimating construction costs of the TSP. For this study it was determined that the appropriate contingency to use is 59 percent. This cost contingency was not applied to monitoring costs due to existing contingencies already found within this cost account. This resulted in an overall project contingency of 31%. More details on the Cost Risk Analysis are found in the Cost Annex of this Appendix.

ANNEX

Cost

Costs Estimates for Final Array

Table 1. Cost Estimate for Alternative 33 (TSP)

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$250,000.00	$250,000
Earthwork				
Cut Excavation	cy	95,447	$3.41	$325,474
Clearing & Grubbing	acre	19	$5,600.00	$106,400
Clearing of Trees (No Stump Removal)	acre	13	$2,300.00	$29,900
Erosion Protection				
Seeding & Mulching	sy	60,000	$0.60	$36,000
Fertilizer	lb	1,500	$0.40	$600
Temporary Silt Fencing	lf	3,000	$2.50	$7,500
Temporary Hay or Straw Bales	ea	150	$15.00	$2,250
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	5	$295.00	$1,475
Trees (Swamp Floor)	acre	438	$295.00	$129,210
Nutria Control	acre	443	$1,553.00	$687,979
Construction Costs				**$1,576,788**
Surveying	ls	1	$54,000.00	$54,000
Markups***	%		40%	$630,715
Planning, Engineering and Design	%		12%	$189,215
Construction Management	%		7%	$110,375
Subtotal				**$2,561,093**
Construction Contingency Cost (25%)			25%	$640,273
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$136,000.00	$136,000
Total Project Construction Cost				**$3,337,367**
Interest During Construction (6 Yr Const.)				$438,029
Total Estimated Cost				$3,775,396
Total Estimated Cost Rounded				**$3,780,000**
Annualized Cost (50 yr, 4.375% Interest)				$187,173
Annual Operations and Maintenance*				$9,513
Total Average Annual Cost				$196,686
Rounded Annualized Cost				**$197,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 2. Cost Estimate for Alternative 34

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$150,000.00	$150,000
Earthwork				
Cut Excavation	cy	73,740	$3.41	$251,453
Clearing & Grubbing	acre	11	$5,600.00	$61,600
Clearing of Trees (No Stump Removal)	acre	8	$2,300.00	$18,400
Erosion Protection				
Seeding & Mulching	sy	30,000	$0.60	$18,000
Fertilizer	lb	500	$0.40	$200
Temporary Silt Fencing	lf	1,500	$2.50	$3,750
Temporary Hay or Straw Bales	ea	50	$15.00	$750
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	3	$295.00	$885
Trees (Swamp Floor)	acre	487	$295.00	$143,665
Nutria Control	acre	490	$1,553.00	$760,970
Construction Costs				**$1,409,673**
Surveying	ls	1	$21,600.00	$21,600
Markups***	%		40%	$563,869
Planning, Engineering and Design	%		12%	$169,161
Construction Management	%		7%	$98,677
Subtotal				**$2,262,981**
Construction Contingency Cost (25%)			25%	$565,745
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$144,000.00	$144,000
Total Project Construction Cost				**$2,972,726**
Interest During Construction (2 Yr Const.)				$390,170
Total Estimated Cost				$3,362,896
Total Estimated Cost Rounded				**$3,370,000**
Annualized Cost (50 yr, 4.375% Interest)				$166,723
Annual Operations and Maintenance*				$6,948
Total Average Annual Cost				**$173,671**
Rounded Annualized Cost				**$174,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 3. Cost Estimate for Alternative 35

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$150,000.00	$150,000
Earthwork				
Cut Excavation	cy	60,468	$3.41	$206,196
Clearing & Grubbing	acre	7	$5,600.00	$39,200
Clearing of Trees (No Stump Removal)	acre	7	$2,300.00	$16,100
Erosion Protection				
Seeding & Mulching	sy	30,000	$0.60	$18,000
Fertilizer	lb	500	$0.40	$200
Temporary Silt Fencing	lf	1,500	$2.50	$3,750
Temporary Hay or Straw Bales	ea	50	$15.00	$750
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	3	$295.00	$885
Trees (Swamp Floor)	acre	0	$295.00	$0
Nutria Control	acre	3	$1,553.00	$4,659
Construction Costs				**$439,740**
Surveying	ls	1	$21,600.00	$21,600
Markups***	%		40%	$175,896
Planning, Engineering and Design	%		12%	$52,769
Construction Management	%		7%	$30,782
Subtotal				**$720,786**
Construction Contingency Cost (25%)			25%	$180,197
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$62,000.00	$62,000
Total Project Construction Cost				**$962,983**
Interest During Construction (6 Yr Const.)				$126,392
Total Estimated Cost				$1,089,375
Total Estimated Cost Rounded				**$1,090,000**
Annualized Cost (50 yr, 4.375% Interest)				$54,008
Annual Operations and Maintenance*				$6,948
Total Average Annual Cost				**$60,956**
Rounded Annualized Cost				**$61,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 4. Cost Estimate for Alternative 36

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$300,000.00	$300,000
Earthwork				
Cut Excavation	ls	169,187	$3.41	$576,928
Clearing & Grubbing	acre	29	$5,600.00	$162,400
Clearing of Trees (No Stump Removal)	acre	21	$2,300.00	$48,300
Erosion Protection				
Seeding & Mulching	sy	90,000	$0.60	$54,000
Fertilizer	lb	2,000	$0.40	$800
Temporary Silt Fencing	lf	4,500	$2.50	$11,250
Temporary Hay or Straw Bales	ea	200	$15.00	$3,000
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	8	$295.00	$2,360
Trees (Swamp Floor)	acre	925	$295.00	$272,875
Nutria Control	acre	933	$1,553.00	$1,448,949
Construction Costs				**$2,880,862**
Surveying	ls	1	$70,200.00	$70,200
Markups***	%		40%	$1,152,345
Planning, Engineering and Design	%		12%	$345,703
Construction Management	%		7%	$201,660
Subtotal				**$4,650,770**
Construction Contingency Cost (25%)			25%	$1,162,693
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$259,000.00	$259,000
Total Project Construction Cost				**$6,072,463**
Interest During Construction (6 Yr Const.)				$797,011
Total Estimated Cost				$6,869,473
Total Estimated Cost Rounded				**$6,870,000**
Annualized Cost (50 yr, 4.375% Interest)				$340,569
Annual Operations and Maintenance*				$10,796
Total Average Annual Cost				**$351,365**
Rounded Annualized Cost				**$351,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 5. Cost Estimate for Alternative 37

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$200,000.00	$200,000
Earthwork				
Cut Excavation	ls	134,208	$3.41	$457,649
Clearing & Grubbing	acre	15	$5,600.00	$84,000
Clearing of Trees (No Stump Removal)	acre	18	$2,300.00	$41,400
Erosion Protection				
Seeding & Mulching	sy	60,000	$0.60	$36,000
Fertilizer	lb	1,000	$0.40	$400
Temporary Silt Fencing	lf	3,000	$2.50	$7,500
Temporary Hay or Straw Bales	ea	100	$15.00	$1,500
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	5	$295.00	$1,475
Trees (Swamp Floor)	acre	487	$295.00	$143,665
Nutria Control	acre	492	$1,553.00	$764,076
Construction Costs				**$1,737,665**
Surveying	ls	1	$70,200.00	$70,200
Markups***	%		40%	$695,066
Planning, Engineering and Design	%		12%	$208,520
Construction Management	%		7%	$121,637
Subtotal				**$2,833,088**
Construction Contingency Cost (25%)			25%	$708,272
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$185,000.00	$185,000
Total Project Construction Cost				**$3,726,360**
Interest During Construction (6 Yr Const.)				$489,085
Total Estimated Cost				$4,215,444
Total Estimated Cost Rounded				**$4,210,000**
Annualized Cost (50 yr, 4.375% Interest)				$208,990
Annual Operations and Maintenance*				$8,230
Total Average Annual Cost				**$217,220**
Rounded Annualized Cost				**$217,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 6. Cost Estimate for Alternative 38

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$300,000.00	$300,000
Earthwork				
Cut Excavation	ls	155,915	$3.41	$531,670
Clearing & Grubbing	acre	19	$5,600.00	$106,400
Clearing of Trees (No Stump Removal)	acre	26	$2,300.00	$59,800
Erosion Protection				
Seeding & Mulching	sy	90,000	$0.60	$54,000
Fertilizer	lb	2,000	$0.40	$800
Temporary Silt Fencing	lf	4,500	$2.50	$11,250
Temporary Hay or Straw Bales	ea	200	$15.00	$3,000
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	7	$295.00	$2,065
Trees (Swamp Floor)	acre	438	$295.00	$129,210
Nutria Control	acre	445	$1,553.00	$691,085
Construction Costs				**$1,889,280**
Surveying	ls	1	$70,200.00	$70,200
Markups***	%		40%	$755,712
Planning, Engineering and Design	%		12%	$226,714
Construction Management	%		7%	$132,250
Subtotal				**$3,074,155**
Construction Contingency Cost (25%)			25%	$768,539
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$178,000.00	$178,000
Total Project Construction Cost				**$4,020,694**
Interest During Construction (6 Yr Const.)				$527,716
Total Estimated Cost				$4,548,410
Total Estimated Cost Rounded				**$4,550,000**
Annualized Cost (50 yr, 4.375% Interest)				$225,497
Annual Operations and Maintenance*				$10,796
Total Average Annual Cost				$236,293
Rounded Annualized Cost				**$236,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

Table 7. Cost Estimate for Alternative 39 (NER)

Item	Unit	Estimated Quantity	Unit Price	Estimated Cost
Mobilization & Demobilization	ls	1	$350,000.00	$350,000
Earthwork				
Cut Excavation	ls	229,655	$3.41	$783,124
Clearing & Grubbing	acre	37	$5,600.00	$207,200
Clearing of Trees (No Stump Removal)	acre	27	$2,300.00	$62,100
Erosion Protection				
Seeding & Mulching	sy	120,000	$0.60	$72,000
Fertilizer	lb	2,500	$0.40	$1,000
Temporary Silt Fencing	lf	6,000	$2.50	$15,000
Temporary Hay or Straw Bales	ea	250	$15.00	$3,750
Vegetative Plantings				
Trees (Dredged Material Berm)	acre	10	$295.00	$2,950
Trees (Swamp Floor)	acre	925	$295.00	$272,875
Nutria Control & Labor	acre	935	$1,553.00	$1,452,055
Construction Costs				**$3,222,054**
Surveying	ls	1	$86,400.00	$86,400
Markups***	%		40%	$1,288,821
Planning, Engineering and Design	%		12%	$386,646
Construction Management	%		7%	$225,544
Subtotal				**$5,209,465**
Construction Contingency Cost (25%)			25%	$1,302,366
Real Estate				
Land Costs (Easements/Access/Leases)**	ls	1	$301,000.00	$301,000
Total Project Construction Cost				$6,812,831
Interest During Construction (6 Yr Const.)				$894,184
Total Estimated Cost				**$7,707,016**
Total Estimated Cost Rounded				**$7,700,000**
Annualized Cost (50 yr, 4.375% Interest)				$382,092
Annual Operations and Maintenance*				$12,079
Total Average Annual Cost				$394,171
Rounded Annualized Cost				**$394,000**

Estimates are in 2010 Dollars; Costs are preliminary estimates for planning purposes only and do not represent a fully funded cost estimate.
Average Annual Cost based upon 50 yr project life, 4.375% interest, and 6 year construction period
Interest During Construction Rate = ((1.04375 ^ 2) -1) * .5
* Additional Mobilization/Demobilization Cost of $20,000 Required for All Implementations
** 25% Contingency Included
*** Markups include Home Office and Job Office Overhead (10% each), Profit (10%), Bond (1%), and Subcontractors (Approx 8%)

ANNEX 10-1

Total Project Cost Summary

Project	LCA Amite River Diversion Canal Modification
Location:	Livingston Parish, LA
Document	The project cost reflects the scope and schedule in the NEPA report.
Contract	Total of TSP, Alternative 33

District: MVN
POC: Puls, Jonathan

Date: 21-Jul-10
Page: 1 of 1

Program Year (Budget EC): 2011
Effective Price Level Date: 1 Jan 10

WBS Number	Civil Works Feature & Sub-Feature Description	Effective Price level-Unit Price Estimate Cost $K	Cntg %	Cntg $K	Total $K	Esc %	FULLY FUNDED PROJECT ESTIMATE Cost $K	Cntg $K	Total $K	Mid Pt Date	Esc %	Cost $K	Cntg $K	Total $K
9	CHANNELS & CANALS	$ 2,591	59%	$ 1,529	$ 4,120	1.0%	$ 2,618	$ 1,544	$ 4,162	Apr-15	8.1%	$ 2,801	$ 1,653	$ 4,453
06	FISH AND WILDLIFE	$ 2,971	0%	$ -	$ 2,971	0.0%	$ 2,971	$ -	$ 2,971		0.0%	$ 2,971	$ -	$ 2,971
	CONSTRUCTION ESTIMATE TOTALS:	$ 5,562		$ 1,529	$ 7,091	1.0%	$ 5,589	$ 1,544	$ 7,133	Apr-15	8.1%	$ 5,772	$ 1,653	$ 7,425
01	LANDS AND DAMAGES	$ 113	59%	$ 67	$ 180	0.0%	$ 113	$ 67	$ 180	Sep-12	0.0%	$ 113	$ 67	$ 180
30	PLANNING, ENGINEERING & DESIGN	$ 311	59%	$ 183	$ 494	1.0%	$ 314	$ 185	$ 499	Apr-15	8.1%	$ 336	$ 198	$ 534
31	CONSTRUCTION MANAGEMENT	$ 233	59%	$ 138	$ 371	1.0%	$ 236	$ 139	$ 374	Apr-15	8.1%	$ 252	$ 149	$ 401
	PROJECT COST TOTALS:	$ 6,219	31%	$ 1,916	$ 8,136	0.6%	$ 6,251	$ 1,935	$ 8,187		4.1%	$ 6,473	$ 2,066	$ 8,539

Project Manager

Chief Cost Engineer

ESTIMATED FEDERAL COST:	5,551
ESTIMATED NON-FEDERAL COST:	2,989
ESTIMATED TOTAL PROJECT COST:	8,539

US Army Corps
of Engineers

New Orleans District

Amite River Diversion Canal Modification Project
Ascension and Livingston Parishes, Louisiana

Cost Narrative Report
Draft Submittal

July, 2010

Amite River Diversion Canal Modification Project
Cost Narrative

1. Project Description

a. General: Title VII of the Water Resources Development Act (WRDA) 2007 authorizes the Louisiana Coastal Area (LCA) program. The authority includes requirements for comprehensive coastal restoration planning, program governance, project modification investigations, a Science and Technology (S&T) program, restoration project construction, a program for beneficial use of dredged material, feasibility studies for restoration plan components, and other program elements.

b. Purpose: The LCA ARDC Integrated Feasibility Study is being developed as a supplement to the *Louisiana Coastal Area (LCA) Louisiana Ecosystem Restoration: Comprehensive Coast-wide Ecosystem Restoration Study* (LCA Near-term Restoration Plan) and is intended to meet the requirements of the Water Resources Development Act (WRDA) of 2007, Section 7006(e). This feasibility study is anticipated to result in a Chief of Engineers Report containing a recommended LCA ARDC Plan (Plan). The Plan addresses systematic restoration of bald cypress-tupelo swamp in areas affected by the ARDC, and considers measures to prevent future bald cypress-tupelo swamp degradation and conversion, restore sheet flow impaired by dredged material bank construction, and protect vital socioeconomic and public resources. The Plan addresses ecosystem restoration exclusively, and does not impair or alter the flood control capabilities of the ARDC. The Plan is independent of, but synergistic with, other LCA near-term critical features, as well as coastal restoration projects proposed under other authorities to provide a holistic approach to restore impaired swamp habitat in the western Maurepas Swamp.

c. Design Features: Features include dredge material berm cuts, railroad grade cuts, conveyance channel cuts, vegetative clearing, and vegetative plantings.

2. Basis of Estimate

a. Basis of Design: LCA ARDC Integrated Feasibility Report and Draft Supplemental Environmental Impact Statement (DSEIS) and the ARDC Phase 1 Environmental Site Assessment. This project's site plan is presented in Section 6 of Appendix L of the LCA ARDC Integrated Feasibility Report and DSEIS.

b. Basis of Quantities: The estimate is based on the overall quantities provided by the designer. These overall quantities along with additional detailed quantity estimates are presented in Section 6 of Appendix L of the LCA ARDC Integrated Feasibility Report and DSEIS.

3. Design and Construction Schedule

Milestone	Baseline Date
Begin Pre Construction Engineering and Design	August 2010
Initiation of Monitoring Program	November 2010
USACE and non-Federal sponsor negotiate PPA	April 2012
Complete Plans and Specifications	January 2012
Real Estate Acquisition	August 2012
Award Contract	October 2012
Construction Start	□ □□2012
Complete Construction- Earthwork	□□□□□ □□□201□
Complete 1st Vegetation Planting	April 2015
Complete 2nd Vegetation Planting	April 2018
Turnover Project to Local Sponsor	August 2018
Complete Monitoring Program	March 2023

a. Overtime: Overtime is included in the estimate for this project.

b. Construction Windows: It is estimated that civil construction of the project will take approximately nine months to complete. Competition of the first and second vegetative plantings will take approximately four years (including time for site assessments).

4. Contracting Plan

It is assumed that the project will be contracted to one prime construction contractor and one sub contractor for the vegetative plantings.

5. Project Construction

a. Site Access: The construction laborers, equipment, and other personnel will be staged in an area with access to the ARDC, most likely along LA-22 or north of the study area. The necessary equipment will be transported in and out via barge on an as-needed basis. Laborers will be transported in and out of the project area via crew boats on a daily basis.

b. Borrow Areas: There is no requirement for borrow material to be brought in from outside the project area. All excavated material resulting from construction of the project will be placed within the project footprint.

c. Construction Methodology:
1) Mobilization: This cost item includes the mobilization and demobilization of two amphibious, short-reach excavators, a D6 Dozer, a log skidder, a barge, and a crew boat.

This cost item includes the rental cost for the equipment and labor required to haul the construction equipment to and from the job site. It is assumed that one truck driver and a laborer is needed for each truck used to haul equipment. This item also includes the costs for transporting the work crew in and out of the construction area with a crew boat.

The crew boat will be used to transport workers to and from the construction area on a daily basis. Prices provided by Hackco, Inc. http://hackcoinc.com/ 337-762-4703. Price includes captain, mob/demob, fuel, 1 crew boat throughout construction (22 weeks @ 7 days/week rental = 154 days). Prices are for the first quarter of 2010. 1 laborer will be used for daily work on the barge, for a total of 840 hours (40 hours x 21 weeks). A work barge is to be used for transporting equipment during construction. The barge will be needed for 21 weeks @ 7days/week = 147 days.

2) The appropriate construction areas will be cleared of trees and stumps before excavation of the cuts and conveyance channels begins. Some areas of the construction footprint do not require that the stumps be removed (Sloped and disposal areas). All stumps will be removed from the proposed conveyance channel excavation sites. This cost item represents the removal of trees within the proposed construction footprint. All trees will be disposed of on-site by selectively cutting the trees into smaller sections and leaving them in the interior swamp in a manner that does not impeded hydrologic flow.

3) All cuts and channels will be excavated from the ARDC into the swamp areas. Excavation will proceed from the ARDC into the swamp via the cuts and conveyance channels as they are constructed. The conveyance channels will be the primary means of transportation during construction.

For two amphibious, short-reach excavators (2.5 CY bucket) @ $285/hr (Rental price provided by MVN, price includes crew), with a cycle time of 120 CY/hr of material handled. A 50-minute hour and a 80% productivity markup were used for this calculation (95,477 CY/120 CY/hr = 796 hr * 1.17 * 1.2 = 1,118 hrs). This gives an overall unit cost of $3.33 per cubic yard (1,118 hrs x $285 = $318,630, $318,630/95,477 CY = $3.33). To accommodate the superintendent over a six month period an added sustenance cost of $6,720 will be included to the MCACES estimate (6 months x 4 weeks x 5 days x $56 per day). The per diem rate of $56.00 per day for Baton Rouge, LA. was used. This raised the unit cost to $3.41 per cubic yard. This cost was obtained for the first quarter of 2010.

4) Material will be placed along the sides of the newly-constructed conveyance channels as depicted in Section 3 of the LCA ARDC Integrated Feasibility Report and DSEIS. Two amphibious, short-reach excavators will remove the material from the proposed conveyance channel locations. Stumps from the channels will also be placed along the appropriate disposal sites.

5) Vegetative plantings will be implemented within the appropriate areas in two phases. Plantings will be implemented with a density of 173 trees per acre. The trees to be planted will consist of approximately 15% 1-gallon potted seedlings, 10% 3-gallon potted

seedlings and 75% bare-root seedlings. Nutria guards will be installed on all planted trees. It is assumed that approximately 50% of the initial planting will need to be replanted with a two year period of the initial plantings.

This item represents the primary and secondary plantings to be implemented on the newly created dredged material berms upon completion of the earthmoving phase of construction. A cost of $10.00 per 3 gal. potted plant, $4.00 per 1 gal. potted plant, and $0.15 per seedling was assumed. It was determined that an initial planting consisting of 15% 1 gal. potted plants, 10% 3 gal. potted plants, and 75% bare-root seedlings would be implemented. An initial planting will begin 7 months after the earthmoving phase of construction is completed. A secondary planting of approximately 50% of the size of the initial planting will begin 23 months after the initial planting is completed. When planting 173 trees per acre (Including secondary planting), 26 will be 1 gallon potted, another 17 will be 3 gallon potted and 129 will be bare-root for each acre planted. This equates to a per acre cost of $295. The cost including installing nutria guards is $1,533 per acre. This includes the labor required for planting the trees, purchasing the nutria guard materials, and installing the guards. Productivity is already accounted for with the 50% replanting. Prices provided by NCRS via the USFWS (Last Quarter 2009).

6) Surveying - It is assumed that a four-man crew will need to work with the following breakdown: 3 days of mobilization per cut, 5 days per cut to layout the construction footprint, 4 days per cut to produce as-builts. This is assumed to be done at 80% productivity. This gives 30 days of work at an estimated cost of $1,500 per day, at 80% efficiency for a total of $54,000. This quote was provided by Jim Smith of the Stanley Group for the first quarter of 2010 (225-388-4208).

6. Lands and Damages

This cost item includes the Lands & Damages involved with the implementation of the proposed action. No land will be purchased outright, but conservation, depositional, and flowage easements will be required. A 59% contingency (as determined by the a risk analysis) will be added to these costs. Details behind these costs may be found in Appendix J of the LCA ARDC Integrated Report.

7. Planning, Engineering, and Design (PED)

These costs include the planning, engineering, and design required before construction of the LCA ARDC project is to commence. It was estimated that this cost would be 12% of the total estimated construction costs. A 59% contingency (based on a risk analysis) will be added to this cost item.

8. Construction Management (CM)

These costs include the construction management required during construction of the LCA ARDC project. It was estimated that this cost would be 9% of the total estimated construction costs. A 59% contingency (based on a risk analysis) will be added to this cost item.

9. Fish and Wildlife

This costs item includes the monitoring of project performance and for the project area, once construction is completed. Monitoring will be conducted for the first ten years upon completion of construction. This cost was determined from an Adaptive Management and Monitoring Report, which is included in Appendix I of the LCA ARDC Integrated Report. An escalation of 2.6% is included for this cost item, therefore no escalation was applied within the Total Project Cost Summary Sheet.

10. Environmental Concerns

To ensure that sediments do not leave the construction site during construction, Best Management Practices including hay bales, silt fencing, and seeding and mulching will be implemented.

11. Effective Dates for Labor, Equipment, and Material Pricing

The labor, equipment, and material pricing were developed using the MCACES 2008 English Unit Cost Library, 2008 Labor Library, and the 2008 Equipment Library and the 2008 Equipment Library (Region III) for the base estimate. The base estimate has been currently updated with current market wage rates for Livingston Parish, Louisiana, current quoted material prices, production rates, fuel prices and specialty equipment costs in Louisiana. The index pricing data has been prepared in June, 2008 dollars based on the data listed below and escalated to February 2010 dollars.

a. Labor and Equipment Productivity: The estimate includes an overall Production Index of 80 percent on selected items which is based on anticipated project difficulty, method of construction, labor availability, supervision, job conditions, weather, and expected delays. The productivity is built into the unit cost for some items as stipulated in the item description.

12. Project Mark ups

a. Escalation The project costs were determined in 2010 dollars and escalated to February 2011 dollars as shown in Section 10 of Appendix L of the LCA ARDC report.

b. Contingency A risk analysis was performed in accordance with ER 1110-2-1302. The risk registry developed for this project is located in Section 10 Appendix L of the LCA ARDC report. This analysis suggested a contingency of 59% be applied to the final constructions costs, before Planning, Engineering and Design along with Construction Management were added.

This is the MCACES Cost Estimate for the LCA Amite River Diversion Canal Modification Project. The purpose of this project is to restore natural hydrologic connectivity between the ARDC and the surrounding swamp habitat. It is proposed that five cuts, along with conveyance channels, be placed in the existing dredged material berm to allow sediment and nutrient exchange throughout the area and to reduce impoundment.

Estimated by Jonathan Puls & Robert Manes
Designed by GEC, Inc.
Prepared by Jonathan Puls & Robert Manes
Preparation Date 12/17/2009
Effective Date of Pricing 12/17/2009
Estimated Construction Time Days

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Description	Quantity	UOM	ContractCost	ProjectCost	C/O
Project Cost Summary Report			**6,219,286**	**6,219,286**	
			2,590,980.06	*2,590,980.06*	
09 09 - Construction Costs	**1.00**	**EA**	**2,590,980**	**2,590,980**	
			400,010.40	*400,010.40*	
09-01 09-01 Mob & Demob, Contractor	**1.00**	**EA**	**400,010**	**400,010**	
			245,719.32	*245,719.32*	
09-01-01 09-01-01 Mob/Demob Equipment to be Towed	**1.00**	**EA**	**245,719**	**245,719**	
			245,719.32	*245,719.32*	
09-01-01-01 09-01-01-01 Mob/Demob Crew Boat	**1.00**	**EA**	**245,719**	**245,719**	
			1,830.50	*1,830.50*	
09-01-02 09-01-02 Mob/Demob Equipment to be Hauled and Operated	**1.00**	**EA**	**1,831**	**1,831**	
			502.49	*502.49*	
09-01-02-01 09-01-02-01 Mob/Demob Log Skidder	**1.00**	**EA**	**502**	**502**	
			502.49	*502.49*	
09-01-05-01 09-01-02-02 Mob Marsh Backhoe	**2.00**	**EA**	**1,005**	**1,005**	
			323.03	*323.03*	
09-01-02-02 09-01-02-03 Mob/Demob D6 Dozer	**1.00**	**EA**	**323**	**323**	
			20,160.40	*20,160.40*	
09-01-03 09-01-03 Workers	**1.00**	**EA**	**20,160**	**20,160**	
			132,300.18	*132,300.18*	
09-01-04 09-01-04 Mob/Demob Equipment	**1.00**	**EA**	**132,300**	**132,300**	
			209,698.53	*209,698.53*	
09-02 09-02 Site Preperation	**1.00**	**EA**	**209,699**	**209,699**	
			432,902.89	*432,902.89*	
09-03 09-03 Earthwork	**1.00**	**EA**	**432,903**	**432,903**	
			115,896.41	*115,896.41*	
09-04 09-04 Erosion Protection	**1.00**	**EA**	**115,896**	**115,896**	
			1,360,670.73	*1,360,670.73*	
09-05 09-05 Vegetative Planting	**1.00**	**EA**	**1,360,671**	**1,360,671**	
			71,801.10	*71,801.10*	
09-06 Surveying	**1.00**	**EA**	**71,801**	**71,801**	
			113,000.00	*113,000.00*	
01 - Lands & Damages	**1.00**	**EA**	**113,000**	**113,000**	
			2,971,200.00	*2,971,200.00*	
06 - Fish & Wildlife	**1.00**	**EA**	**2,971,200**	**2,971,200**	

Description	Quantity	UOM	ContractCost	ProjectCost	C/O
			310,918.00	*310,918.00*	
30 - PED	**1.00**	**EA**	**310,918**	**310,918**	
			233,188.00	*233,188.00*	
31 - Construction Management	**1.00**	**EA**	**233,188**	**233,188**	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
Project Direct Costs Report				**101,629**	**398,924**	**158,411**	**4,695,862**	**0**	**5,354,825**	
				101,629.13	*398,923.53*	*158,411.25*	*1,067,555.57*		*1,726,519.48*	
09 09 - Construction Costs	**1.00**	**EA**	**Prime Contractor**	**101,629**	**398,924**	**158,411**	**1,067,556**	**0**	**1,726,519**	
(Note: The overall construction for this project involves the excavation of three cuts, along with bifurcated conveyancve channels, through the dredged material berms and the interior swamp habitat, respectively. The dredged material will be placed along the existing berm, along the proposed conveyance channels, in order to maintain sheet flow throughout the area. Once these cuts and channels are excavated and the construction area is allowed to settle, two phases of vegetative plantings will be implemented for portions of the interior swamp and for all of the dredged material placed during construction. The productivity of this construction project is assumed to be 80% for specific cost items associated with this cost estimate. It is estimated that construction will begin in the last quarter of 2012. The TPCS found in Appendix L of the combined report gives the overall project costs along with all associated contigencies and escalation.)										
				15,599.24	*285,239.63*	*0.00*	*0.00*		*300,838.86*	
09-01 09-01 Mob & Demob, Contractor	**1.00**	**EA**	**Prime Contractor**	**15,599**	**285,240**	**0**	**0**	**0**	**300,839**	
(Note: This cost item includes the mobilization and demobilization of two amphibious, short-reach excavators, a D6 Dozer, a log skidder, a barge, and a crew boat. This cost item includes the renatal cost for the equipment and labor required to haul the construction equipment to and from the job site. It is assumed that one truck driver and a laborer is needed for each truck used to haul equipment. This item also includes the costs for transporting the work crew in and out of the construction area with a crew boat.)										
				0.00	*184,800.00*	*0.00*	*0.00*		*184,800.00*	
09-01-01 09-01-01 Mob/Demob Equipment to be Towed	**1.00**	**EA**	**Prime Contractor**	**0**	**184,800**	**0**	**0**	**0**	**184,800**	
(Note: This cost item represents the cost for renting a crew boat to use during construction.)										
				0.00	*184,800.00*	*0.00*	*0.00*		*184,800.00*	
09-01-01-01 09-01-01-01 Mob/Demob Crew Boat	**1.00**	**EA**	**Prime Contractor**	**0**	**184,800**	**0**	**0**	**0**	**184,800**	
(Note: The crew boat will be used to transport workers to and from the construction area on a daily basis.)										
				0.00	*1,200.00*	*0.00*	*0.00*		*1,200.00*	
USR Mob/Demob Crew Boat	154.00	DAY	Prime Contractor	0	184,800	0	0	0	184,800	E
(Note: The crew boat will be used to transport workers to and from the construction area on a daily basis. Prices provided by Hackco, Inc. Prices provided by Hackco, Inc. http://hackcoinc.com/ 337-762-4703 Includes captain, mob/demob, fuel, 1 crew boat is needed throughout construction (22 weeks @ 7 days/week rental = 154 dyas) Prices are for the first quarter of 2010.)										
				437.05	*939.63*	*0.00*	*0.00*		*1,376.68*	
09-01-02 09-01-02 Mob/Demob Equipment to be Hauled and Operated	**1.00**	**EA**	**Prime Contractor**	**437**	**940**	**0**	**0**	**0**	**1,377**	
(Note: This cost item represent the Mob/Demob of the equipment to be hauled to the job site. This equipment includes a log skidder, two hydraulic excavators and a D6 dozer.)										
				116.55	*261.36*	*0.00*	*0.00*		*377.91*	
09-01-02-01 09-01-02-01 Mob/Demob Log Skidder	**1.00**	**EA**	**Prime Contractor**	**117**	**261**	**0**	**0**	**0**	**378**	
(Note: This cost item is for the Mob/Demob of a log skidder.)										
				58.27	*130.68*	*0.00*	*0.00*		*188.96*	
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	2.00	EA	Prime Contractor	117	261	0	0	0	378	N
(Note: The quantity is given as two to account for both the mobilization and the demobilization. Labor and equipment is included in the cost.)										
				116.55	*261.36*	*0.00*	*0.00*		*377.91*	
09-01-05-01 09-01-02-02 Mob Marsh	**2.00**	**EA**	**Prime**	**233**	**523**	**0**	**0**	**0**	**756**	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
Backhoe			**Contractor**							
(Note: This cost item represent the Mob/Demob cost of hauling two amphibious short-reach hydraulic excavator to be used to construct the cuts and conveyance channels. This cost includes equipment and labor.)										
				58.27	*130.68*	*0.00*	*0.00*		*188.96*	
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	4.00	EA	Prime Contractor	233	523	0	0	0	756	N
(Note: The quantity is given as four to account for both the mobilization and the demobilization of both excavators. Labor and equipment is included in the cost. These excavators are have a 30-foot reach and a 2.5 CY bucket. They also have a cycle time of 120 CY/hr.)										
				87.41	*155.54*	*0.00*	*0.00*		*242.95*	
09-01-02-02 09-01-02-03 Mob/Demob D6 Dozer	**1.00**	**EA**	**Prime Contractor**	**87**	**156**	**0**	**0**	**0**	**243**	
(Note: This cost item is for the Mob/Demob of a D6 dozer.)										
				43.71	*77.77*	*0.00*	*0.00*		*121.47*	
RSM 015436500020 Mobilization or demobilization, dozer, loader, backhoe or excavator, 70 H.P. to 250 H.P., up to 50 miles	2.00	EA	Prime Contractor	87	156	0	0	0	243	N
(Note: The quantity is given as two to account for both the mobilization and the demobilization. Labor and equipment is included in the cost.)										
				15,162.18	*0.00*	*0.00*	*0.00*		*15,162.18*	
09-01-03 09-01-03 Workers	**1.00**	**EA**	**Prime Contractor**	**15,162**	**0**	**0**	**0**	**0**	**15,162**	
(Note: This cost includes the labor needed to help with the loading/unloading of the barges on the docking and upkeep required on a daily basis.)										
				18.05	*0.00*	*0.00*	*0.00*		*18.05*	
MIL B-LABORER Laborers, (Semi-Skilled)	840.00	HR	Prime Contractor	15,162	0	0	0	0	15,162	N
(Note: 1 laborer will be used for daily work on the barge. In total (1 barge @ 840 hours).)										
				0.00	*99,500.00*	*0.00*	*0.00*		*99,500.00*	
09-01-04 09-01-04 Mob/Demob Equipment	**1.00**	**EA**	**Prime Contractor**	**0**	**99,500**	**0**	**0**	**0**	**99,500**	
(Note: This cost item represents the equipment needed for the Mob/Demob of the barge to be used during construction. A tug boat is rented to bring the barge to and from the job site before and after the earthmoving phase of construction.)										
				0.00	*400.00*	*0.00*	*0.00*		*400.00*	
MAP XX0XX700 WORK BARGE, FLAT DECK , 500 TON APPROX. 60'x 35' x 8',WOOD DECK (Mob/Demob)	147.00	DAY	Prime Contractor	0	58,800	0	0	0	58,800	E
(Note: A work barge is to be used for transporting equipment during construction. The barge will be needed for 21 weeks @ 7days/week = 147 days.)										
				0.00	*1,850.00*	*0.00*	*0.00*		*1,850.00*	
USR Tug Boat - 900 HP	22.00	DAY	Prime Contractor	0	40,700	0	0	0	40,700	E
(Note: A tug boat is required to mob/demob the barges to be used during construction and tp push the barges from one cut to another. Price obtained from B&J Tug Boat and Barge Rentals 337-912-0974, includes captain. 4 days for mob/demob, crew boat can push barge from cut to cut and to loading zone (Twin 250 hp engines). Price obtained in the first quarter of 2010.)										
				50,949.24	*106,760.34*	*0.00*	*0.00*		*157,709.57*	
09-02 09-02 Site Preperation	**1.00**	**EA**	**Prime Contractor**	**50,949**	**106,760**	**0**	**0**	**0**	**157,710**	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
(Note: This cost item represents the general clearing of the areas to be excavated along the dredged material berms and the proposed conveyance channels. A log skidder and a laborer will be used to chainsaw the trees and the dozer and will help push them to the appropriate disposal areas. This cost includes both equipment and labor.)										
				520.48	*1,022.20*	*0.00*	*0.00*		*1,542.67*	
HNC 311313101050 Selective clearing, wet clearing, heavy brush and trees, excludes removal offsite	31.00	ACR	Prime Contractor	16,135	31,688	0	0	0	47,823	N
(Note: This cost item represents the removal of trees within the proposed construction footprint. All trees will be disposed of on-site by selectively cutting the trees into smaller sections and leaving them in the interior swamp in a manner that does not impeded hydrologic flow.)										
				1,123.05	*2,421.69*	*0.00*	*0.00*		*3,544.73*	
RSM 311110100350 Clearing & grubbing, heavy stumps, to 24" diameter, grub stumps and remove	31.00	ACR	Prime Contractor	34,814	75,072	0	0	0	109,887	N
(Note: This cost item represents the removal of all shrubs, stumps and debris within the proposed project footprint. The stumps will be piled along the proposed dredged material disposal areas. All other material will be disposed of along the swamp floor in a manner that does not impede hydrologic flow within the area.)										
				0.00	*0.00*	*0.00*	*325,576.57*		*325,576.57*	
09-03 09-03 Earthwork	**1.00**	**EA**	**Prime Contractor**	**0**	**0**	**0**	**325,577**	**0**	**325,577**	
(Note: This cost item represents the earthmoving required to construct the proposed cuts through the dredged material berms and the conveyance channels into the interior swamp. The equipment will dig their way in by utilizing the excavated channel as a means of moving into and out of the construction area. The excavators will be amphibious.)										
				0.00	*0.00*	*0.00*	*3.41*		*3.41*	
USR Mechanical Earthmoving	95,477.00	BCY	Prime Contractor	0	0	0	325,577	0	325,577	Sb
(Note: For two amphibious, short-reach excvators (2.5 CY bucket) @ $285/hr (Rental price provided by MVN, including crew and per diem), with a cycle time of 120 CY/hr of material handled. A 50-minute hour and a 80% productivity markup were used for this calcualtion (95,477 CY/120 CY/hr = 796 hr * 1.17 * 1.2 = 1,118 hrs). This gives an over all unit cost of $3.33 per cubic yard (1,118 hrs * $285 = $318,630, $318,630/95,477 CY = $3.33). The rental price used to calculate the $3.33 per CY unit price for excavating includes per diem. This accommodates the heavy equipment operators. To accommodate the superintendent over a six month period an added sustenance cost of $6,720 will be included to the MCACES estimate (6 months x 4 weeks x 5 days x $56 per day). The per diem rate of $56.00 per day for Baton Rouge, LA. was used. This raised the unit cost to $3.41 per cubic yard. This cost was obtained for the first quarter of 2010.)										
				35,080.66	*6,923.56*	*27,726.25*	*0.00*		*69,730.48*	
09-04 09-04 Erosion Protection	**1.00**	**EA**	**Sub-Contractor - Erosion Control**	**35,081**	**6,924**	**27,726**	**0**	**0**	**69,730**	
(Note: This cost item represents the implementation of silt fensing and hay bales used to prevent the loss of sediment due to construction activites. Silt fensing will be utilized along the entire perimeter of the construction area. Hay bales will be used in areas in which water tends to convey through the site. Seeding and mulching will be utilized along the newly formed slopes to limit the loss of sediments and to stabilize the slopes. These prices include equipment and labor.)										
				0.15	*0.12*	*0.30*	*0.00*		*0.56*	
RSM 329219131100 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed	60,000.00	SY	Sub-Contractor - Erosion Control	8,877	6,913	18,000	0	0	33,790	OLEM
(Note: This item represents the seeding implemented to ensure erosion reduction and stability along the newly excavated areas. This cost includes equipment and labor.)										
				2.54	*0.00*	*0.79*	*0.00*		*3.33*	
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	3,000.00	LF	Sub-Contractor - Erosion Control	7,616	0	2,370	0	0	9,986	OLM
(Note: This item represents the silt fencing to be installed along the entire perimeter of the construction area to reduce the amount of sediment leaving the job site. This cost included equipment and labor.)										
				0.31	*0.00*	*0.11*	*0.00*		*0.42*	
RSM 329113161020 Soil preparation,	60,000.00	SY	Sub-Contractor -	18,564	0	6,600	0	0	25,164	OLM

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
mulching, polyethylene film, 1-1/2 mil			Erosion Control							
(Note: This item represent the mulching used along with the seeding to reduce ersoion within the work area. This cost include equipment and labor.)										
				0.19	*0.09*	*6.05*	*0.00*		*6.32*	
RSM 312513101250 Synthetic erosion control, hay bales, staked	125.00	LF	Sub-Contractor - Erosion Control	23	11	756	0	0	790	N
(Note: This item represents the hay bales to be placed in water conveynace areas throughout the construction area to reduce sediment loss due to erosion. This cost includes the nay bales and the labor to install them.)										
				0.00	*0.00*	*130,685.00*	*687,979.00*		*818,664.00*	
09-05 09-05 Vegetative Planting	**1.00**	**EA**	**Sub-Contractor - Vegetative Plantings**	**0**	**0**	**130,685**	**687,979**	**0**	**818,664**	
(Note: This cost includes the initial and secondary vegetative plantings to be implemented along newly-created dredged material placement areas and portions of the swamp floor. It includes the planting of baldcypress and tupelo gum as well as upland tree species such as live oaks.)										
				0.00	*0.00*	*295.00*	*0.00*		*295.00*	
USR Plantings (Material Only - Dredged Material Berms - 25% 1 gal., 25% 3 gal., and 50% seedlings)	5.00	ACR	Sub-Contractor - Vegetative Plantings	0	0	1,475	0	0	1,475	M
(Note: This item represents the primary and secondary plantings to be implemented on the newly created dredged material berms upon completion of the earthmoving phase of construction. A cost of $10.00 per 3 gal. potted plant, $4.00 per 1 gal. potted plant, and $0.15 per seedling was assumed. It was determined that an initial planting consisting of 15% 1 gal. potted plants, 10% 3 gal. potted plants, and 75% bare-root seedlings would be implemented. An initial planting will begin 7 months after the earthmoving phase of construction is completed. A secondary planting of approximately 50% will begin 23 months after the initial planting is completed. When planting 165 trees per acre (Including secondary planting), 25 will be 1 gal. potted, another 17 will be 3 gal. potted and 124 will be bare-root for each acre planted. This equates to a per acre cost of $283. The cost installing nutria guards is $1,485 per acre. This price includes the labor required for planting the trees and installing the gaurds, as well as the nutria guard materials. The area was determined through GIS analysis. Productivity is already accounted for with the 50% replanting. Prices provided by NCRS via the USFWS (Last Quarter 2009).)										
				0.00	*0.00*	*295.00*	*0.00*		*295.00*	
USR Plantings (Material Only - Swamp Floor - 25% 1 gal., 25% 3 gal., and 50% seedlings)	438.00	ACR	Sub-Contractor - Vegetative Plantings	0	0	129,210	0	0	129,210	M
(Note: This item represents the primary and secondary plantings to be implemented on the newly created dredged material berms upon completion of the earthmoving phase of construction. A cost of $10.00 per 3 gal. potted plant, $4.00 per 1 gal. potted plant, and $0.15 per seedling was assumed. It was determined that an initial planting consisting of 15% 1 gal. potted plants, 10% 3 gal. potted plants, and 75% bare-root seedlings would be implemented. An initial planting will begin 7 months after the earthmoving phase of construction is completed. A secondary planting of approximately 50% will begin 23 months after the initial planting is completed. When planting 165 trees per acre (Including secondary planting), 25 will be 1 gal. potted, another 17 will be 3 gal. potted and 124 will be bare-root for each acre planted. This equates to a per acre cost of $283. The cost installing nutria guards is $1,485 per acre. This price includes the labor required for planting the trees and installing the gaurds, as well as the nutria guard materials. The area was determined through GIS analysis. Productivity is already accounted for with the 50% replanting. Prices provided by NCRS via the USFWS (Last Quarter 2009).)										
				0.00	*0.00*	*0.00*	*1,553.00*		*1,553.00*	
USR Nutria Control (Material + Installation) and Planting Labor	443.00	ACR	Sub-Contractor - Vegetative Plantings	0	0	0	687,979	0	687,979	Sb
(Note: Nutria Control is to be implemented for all vegetative planting within the swamp and on the dredged material berms. Nutria control, including installation and planting labor for all seedlings, would be implemented at a cost of $9.00 per seedling for all plantings and each type (Swamp/Berms). Prices provided by NRCS via the USFWS (Last Quarter 2009).)										
				0.00	*0.00*	*0.00*	*54,000.00*		*54,000.00*	
09-06 Surveying	**1.00**	**EA**	**Prime Contractor**	**0**	**0**	**0**	**54,000**	**0**	**54,000**	
(Note: This cost item represents the survey work required during construction. Surveying will be conducted to specify the area of construction prior to the site preperation and earthmoving phases of construction. Survey work will also be conducted to ensure that all cuts and conveyance channels are constructed to specifications.)										
USR Construction Surveying	1.00	LS	Prime Contractor	0	0	0	54,000	0	54,000	Sb

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
(Note: It is assumed that a four-man crew will need to work with the following breakdown: 3 days of mobilization per cut 5 days per cut to layout the construction footprint 4 days per cut to produce as-builts 80% productivity This gives 30 days of work at an estimated cost of $1,500 per day, at 80% efficiency for a total of $54,000 This quote was provided by Jim Smith of the Stanley Group for the first quarter of 2010 (225-388-4208).)										
				0.00	*0.00*	*0.00*	*113,000.00*		*113,000.00*	
01 - Lands & Damages	**1.00**	**EA**		**0**	**0**	**0**	**113,000**	**0**	**113,000**	
				0.00	*0.00*	*0.00*	*113,000.00*		*113,000.00*	
USR Lands & Damages	1.00	EA		0	0	0	113,000	0	113,000	Sb
(Note: This cost item includes the Lands & Damages involved with the implementation of the proposed action. No land will be purchased outright, but conservation, depositional, and flowage easements will be required. A 37% contigency (as determined by the a risk analysis) will be added to these costs. Details behind these costs may be found in Appendix J of the LCA ARDC Integrated Report.)										
				0.00	*0.00*	*0.00*	*2,971,200.00*		*2,971,200.00*	
06 - Fish & Wildlife	**1.00**	**EA**		**0**	**0**	**0**	**2,971,200**	**0**	**2,971,200**	
				0.00	*0.00*	*0.00*	*2,971,200.00*		*2,971,200.00*	
USR Fish and Wildlife	1.00	EA		0	0	0	2,971,200	0	2,971,200	Sb
(Note: This costs item includes the monitoring of project performance and for the project area, once construction is completed. Monitoring will be conducted for the first ten years upon completion of construction. This cost was determined from an Adaptive Management and Monitoring Report, which is included in Appendix 1 of the LCA ARDC Integrated Report.)										
				0.00	*0.00*	*0.00*	*310,918.00*		*310,918.00*	
30 - PED	**1.00**	**EA**		**0**	**0**	**0**	**310,918**	**0**	**310,918**	
				0.00	*0.00*	*0.00*	*310,918.00*		*310,918.00*	
USR Planning, Engineerin, and Design	1.00	EA		0	0	0	310,918	0	310,918	Sb
(Note: These costs include the planning, engineering, and design required before construction of the LCA ARDC project is to commence. It was estimated that this cost would be 12% of the total estimated construction costs. A 37% contingency (based on a risk analysis) will be added to this cost item.)										
				0.00	*0.00*	*0.00*	*233,188.00*		*233,188.00*	
31 - Construction Management	**1.00**	**EA**		**0**	**0**	**0**	**233,188**	**0**	**233,188**	
				0.00	*0.00*	*0.00*	*233,188.00*		*233,188.00*	
USR Construction Management	1.00	EA		0	0	0	233,188	0	233,188	Sb
(Note: These costs include the construction management required during construction of the LCA ARDC project. It was estimated that this cost would be 9% of the total estimated construction costs. A 37% contingency (based on a risk analysis) will be added to this cost item.)										

ANNEX 10-2

US Army Corps of Engineers®

LOUISIANA COASTAL AREA - AMITE RIVER DIVERSION

RISK ANALYSIS REPORT FOR MISSISSIPPI RIVER VALLEY DISTRICT, NEW ORLEANS, LA.

Prepared for:

U.S. Army Corps of Engineers

Prepared by:

GEC, Inc.

Date: 1-21-10

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APPENDIX

APPENDIX A Detailed Risk Register

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EXECUTIVE SUMMARY

This report reviews the cost risk analysis (CRA) for the Louisiana Coastal Area Amite River Diversion Canal (LCA ARDC) Modification project Integrated Feasibility Report and Environmental Impact Statement. The results of this analysis provide the applicable cost contingency to use during cost estimation, while also highlighting the risks associated with the study, design, and construction phases of the project.

The LCA ARDC Modification Project has been identified as a near-term critical feature recommended for study in the November 2004 *LCA Ecosystem Restoration Study* (2004 LCA Plan). Construction of the canal has caused a loss of hydrologic connectivity, a reduction in sediment and nutrient transport, and increased impoundment within the study area. These man-made impacts have resulted in the gradual degradation of the interior swamp habitat as it transitions to a freshwater marsh and eventually an open water habitat. The goal of this project is restore the natural hydrologic water regime within the study area, thereby improving the freshwater swamp habitat.

The CRA described in this report was implemented in an effort to determine a true contingency cost required for cost estimating and based on the risk items associated with the project. The results of this analysis are determined by qualifying and quantifying all potential cost risks and running a *Monte Carlo* simulation to produce the frequency spectrum and probability range for the applied risk costs. The cost contingency is obtained from the 80-percent contingency as determined by this analysis.

A total of 33 potential risk items were developed by the CRA team and applied to a risk registry for analysis. Assumptions were made for each risk item before running the *Monte Carlo* simulation. The result of the simulation gave a 59 percent contingency at the 80-percent confidence level.

The contingency cost for this project was utilized for a Micro Computer Aided Cost Estimation Software (MCACES) estimation of the costs associated with the recommended plan (Alternative 33). The potential cost risks developed during this analysis also serve as an indicator of how to avoid unforeseen escalation of project costs throughout project implementation and therefore, may be used as a valuable tool in all future aspect of the project study, design, and construction planning and estimation.

1. PURPOSE

The purpose of this project is to address the systematic restoration of bald cypress-tupelo swamp in areas affected by the ARDC, while considering measures to prevent future bald cypress-tupelo swamp degradation and conversion, restore sheet flow impaired by dredged material bank construction, and protect vital socioeconomic and public resources. The study area is located in the western Maurepas Swamp in the vicinity of Head of Island, Louisiana and is centered around the ARDC, a flood control channel that extends from the Amite River (at Mile 25) to the Blind River (at Mile 4.8) in Ascension and Livingston Parishes. This project would provide hydrologic restoration in the western Maurepas Swamp.

2. BACKGROUND

Since the construction of the ARDC in 1963, a large portion of the western Maurepas Swamp has been cut off from fresh water, sediments, and nutrients historically provided by the Amite River and other waterbodies in the area because of the construction of spoil banks on either side of the canal. This disruption of natural processes has prevented fresh water from circulating in the swamp during high water flow periods (which prevents nutrients and sediments from reaching the swamps), and has prevented the swamp from draining during low water flow periods (which prevents seedling germination and establishment). Consequently, the swamp is impounded, the trees are highly stressed, and little to no regeneration of bald cypress and water tupelo trees (the dominant vegetation in the western Maurepas Swamp) is occurring. These factors, combined with periodic salinity increases as a result of saline storm surge waters from hurricanes, have severely impaired the western Maurepas Swamp, which is at great risk of conversion to fresh marsh, which would ultimately convert to open water.

The Amite River Diversion Canal Modification Project has been identified as a near-term critical feature recommended for study in the November 2004 *Louisiana Coastal Area (LCA) Ecosystem Restoration Study* (2004 LCA Plan). The Project was authorized under Section 7006(e) of the Water Resources Development Act (WRDA, Public Law 110-114). The Federal sponsor for the Project is the U.S. Army Corps of Engineers (USACE) and the non-Federal sponsor is the State of Louisiana through the Louisiana Coastal Protection and Restoration Authority (CPRA).

3. REPORT SCOPE

The scope of this risk analysis report is to calculate and present the cost contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. This report presents the contingency results for both cost risks for all project features.

Title VII of the Water Resources Development Act (WRDA) 2007 authorizes the Louisiana Coastal Area (LCA) program. The authority includes requirements for comprehensive coastal restoration planning, program governance, project modification investigations, a Science and

Technology (S&T) program, restoration project construction, a program for beneficial use of dredged material, feasibility studies for restoration plan components, and other program elements. This authorization was recommended by the Chief of Engineer's Report, dated January 31, 2005. The report includes the project technical scope and estimates, as developed and presented by (list the name of the product developer by district or design firm). Consequently, these documents serve as the basis for the risk analysis. In general terms, the construction scope consists of the following:

3.1 USACE Risk Analysis Process

This cost risk analysis (CRA) process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

ER 1110-2-1150, Engineering and Design for Civil Works Projects.
ER 1110-2-1302, Civil Works Cost Engineering.
ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
Cost Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.
Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

4. METHODOLOGY/PROCESS

The CRA was conducted by a team of contractors, assembled by GEC, Inc., with varying backgrounds, which include construction, engineering, biological impacts, project management, and cost estimation. The analysis was conducted over approximately a month and a half and

completed on January 11th, 2010. This CRA outcome has recieved approval by Agency Technical Review (ATR) and all comments received from this review have been backchecked and closed out.

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process may also be used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to a cost estimate to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the CRA team are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire CRA team is obtained

using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the CRA team and empirical data from similar projects is desirable and is considered.

A formal CRA meeting was held at GEC for the purposes of identifying and assessing risk factors. The meeting on December 7th, 2009 included capable and qualified representatives from multiple project team disciplines and functions, for example:

Project/program managers.
Contracting/acquisition.
Real Estate.
Relocations.
Environmental.
Civil, structural, geotechnical, and hydraulic design.
Cost and schedule engineers.
Construction.

The formal meeting focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location.

Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The resulting product from the CRA team's discussions is captured within a risk register as presented in section 6 for both cost risk concerns. Note that the risk register records the CRA team's risk concerns, discussions related to those concerns, and potential impacts to the current cost estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost elements identified

by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

This section presents the key assumptions utilized for the CRA. Key assumptions are those that are most likely to significantly effect the determinations and/or estimates of risk presented in the CRA. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The following key assumptions were made by the CRA team.

- The total construction cost was determined by running a MCACES analysis for the recommended plan (Alternative 33).
- An Agency Technical Review will be run on the CRA results.
- There is only one construction account involved with this project.
- The 80-percent confidence contingency would be used as the resultant contingency in the CRA analysis.
- Only moderate, high, and severe risk levels were applied for the purposes of the CRA analysis.

6. RISK ANALYSIS RESULTS

This section presents the results of the CRA, including the information utilized to compile the applicable cost contingency for this project. Additional details behind the CRA are found in Appendix A of this report.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) is presented in Table 1. This risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, are further refined, especially on large projects. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

In simple terms, a correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1.

Correlations are important to understand the logic used in the risk analyses. The mathematical correlations used in the *Monte Carlo* simulations are as follows:

- Present any risk event correlations, addressing their relationships.
- Present the final risk register or the condensed version. At a minimum include those risk events studied (an appendix can include the complete risk register):
- Risk event identifying number.
- Risk or opportunity event.
- CRA team concerns.
- CRA team discussions.
- Project cost likelihood, impact, and risk level.

Descriptions of Risk Items Associated with the LCA ARDC Modification Project

CA-1 Acquisition Strategy Decreasing Competition

Pipeline contractors who would have the equipment and training to do projects such as this would not be interested in such a small project if other larger and more lucrative pipeline projects are available. But, if there are no other projects available, it might be done for less money.

Low: Guidance was provided by the Cost DX team to use a -10% cost impact for this risk item.

Likely: It is assumed that the likely scenario would result in an adequate amount of interested bidders for this project.

High: Guidance was provided by the Cost DX team to use a +20% cost impact for this risk item.

T-1 Unusual Specifications

If specifications are too rigid and the contractor expends significant effort to meet rigid specifications while trying to maintain a rigid time frame, this could increase project cost.

Low: The lowest potential cost would be assuming that the contractor constructed the channels properly, without adding extra manpower or effort to paying undue attention to slopes.

Likely: The most likely case is that the contractor will understand and do this appropriately.

High: There is a chance that the contractor would add extra manpower or equipment to ensure a slope that was unnecessary. This would most likely be accomplished by utilizing an extra excavator during the earthmoving phase of construction to properly compact the slopes. It is estimated they this would require an additional expenditure for 1,300 hours of equipment rental ($512,404).

C-7 Special Equipment and Equipment Availability

Special equipment is required to work in swamp areas. If pipeline contractors are busy with other work, equipment may be harder to come by. On the other hand, if no other projects are creating a demand for this equipment, it may be cheaper than normal.

Low: It was assumed that the market price for the amphibious excavators would be decreased by 10% ($51,240)

Likely: It is assumed that there would be adequate availability for amphibious equipment to work on the earthmoving phase of the project.

High: It was assumed that the market price for the amphibious excavators would be increased by 40% ($204,962).

C-8 In-Water Work

Working in water lends itself to risks that are not inherent on land, and must be considered as a part of determining risks for this project. These risks are quantified in reductions in productivity and in additional bond/insurance requirements for the contractor.

Low: It was assumed that the low and most likely cost impacts would be the same.
Likely: It was assumed that the contractor would have adequate experience with in-water work and would not require an additional markup to accommodate the risk associated with this type of work.
High: It was assumed that an additional insurance markup would be added for the prime contractor of 20% ($748,063).

C-10 Vegetative Planting Mortality

Tree mortality would result in additional costs for the project to ensure that an adequate number of trees are added in the highly-degraded areas of the swamp and dredged material placement areas.

Low: It is assumed that a reduction in vegetative plantinging of 10% would be required for the designated areas at $3,301 per acre (10% of 443 acres = 44 less acres of planting).
Likely: It is assumed that the 50% secondary plantings will be adequate to achieve the required tree densities.
High: It is assumed that an additional planting of 25% would be required for the designated areas at $3,301 per acre (25% of 443 acres = 111 additional acres of planting).

C-11 Potential Contract Modifications
If contract modifications, such as increased quantities and design modifications, are made during project construction, it could cause unexpected costs. The contractor could need additional manpower or equipment to accommodate these changes within the predetermined schedule.
Low: Per previous risk analysis, the accepted most likely amount of Mods / Claims typically adds 2% to 5.5% to overall project cost, used the low of 2%.
Likely: It is anticipated that no contract modifications will be required and therefore, there would be no additional costs resulting from this risk item.
High: Per previous risk analysis, the accepted most likely amount of Mods / Claims typically adds 2% to 5.5% to overall project cost, used the high of 5%.

ES-1 Estimate Captures Scope for All Project Features
Given the unique nature of this project, as well as the challenging terrain, it is likely that some elements will be underestimated or not taken into consideration. It is also possible for the same reasons that costs have been incorrectly overstated. This could lead to increased overall construction costs resulting from the unanticipated or miscalculated cost items.

Low: It is anticipated that the total project cost would be the same as in the most likely **scenario.**
Likely: It is anticipated that the current project cost estimates include all pertinent cost items for **this project.**
High: It is anticipated that the total project cost would increase by approximately 10% ($187,016) due to unforeseen or miscalculated project features.

E-1 Stakeholders Request Late Changes

Given that private property is involved in this project, it is possible for complications to arise, which could lead to additional design or construction considerations.

Low: It is anticipated that there would only be significant cost impacts due to this risk item, therefore no low impact would occur.

Likely: Due to the continued coordination with local landowners within the study area, it is likely that no changes will result from stakeholder requests.

High: It is anticipated that changes that result from stakeholder requests would result in a realignment of the conveyance channels or the addition of sheet piles along the cuts in the dredged material berms. This would result in a cost risk of approximately 10% of the total project costs ($374032).

E-5 Unexpected Escalation on Key Materials (Off-Road Diesel)

An unexpected rise or fall in the cost of off-road diesel could have a significant effect on the cost of this project.

Low: The five year low for this area is $1.58 a gallon for off-road diesel and $1.98 for on-road diesel (30% decrease). This reduction in fuel costs was determined unlikely, so a conservative reduction of 15% was used ($1.92/2.31).

Likely: Current average on-road/off-road diesel fuel prices are $2.72/2.26 a gallon. It has been determined that this will likely remain unchanged.

High: The five year high for this area is $4.80 a gallon (76% increase), which was a result of hurricane Katrina. It is not believed that an increase of this significance will not occur, so a conservative estimate of a 35% increase was used for off-road and on-road diesel ($3.05/3.67).

E-7 Acts of God (seismic events: volcanic activity, earthquakes, tsunamis; or severe weather: freezing, flooding or hurricane)

Hurricanes regularly strike Louisiana, and would create a significant delay and increase in price if one struck during the course of the project. Flooding on the Amite River is a possibility as well.

Low: It is anticipated that the low cost impacts resulting from this risk item would be insignificant to the overall cost of the project.

Likely: It is anticipated that there will not be a cost impact to the project costs as a result of this risk item.

High: It is anticipated that the most significant impact to the project costs, resulting from a tropical storm or hurricane, would be approximately 5% of the overall project costs ($187,015).

Table 1. Summary Risk Register

Risk No.	Risk/Opportunity Event (logic by feature, contract, responsibility)	Project Cost			Minimum Likely Cost ($)	Most Likely Cost ($)	Maximum Likely Cost ($)	Variance Distribution (Cost)
		Likelihood*	Impact*	Risk Level*				
Contract Acquisition Risks								
CA-1	Acquisition strategy decreasing competition	Unlikely	Critical	Moderate	$ 2,331,882.00	$ 2,590,980.00	$ 3,109,176.00	Triangular
Technical Risks								
T-1	Unusual Specifications	Likely	Marginal	Moderate	$ 2,590,980.00	$ 2,590,980.00	$ 3,103,384.00	Triangular
Construction Risks								
C-7	Special equipment and equipment availability	Unlikely	Significant	Moderate	$ 2,331,882.00	$ 2,590,980.00	$ 3,627,372.00	Triangular
C-8	In-water work	Likely	Marginal	Moderate	$ 2,590,980.00	$ 2,590,980.00	$ 3,109,176.00	Triangular
C-10	Vegetative planting mortality	Likely	Marginal	Moderate	$ 2,569,406.00	$ 2,590,980.00	$ 2,645,404.00	Triangular
C-11	Potential contract modifications	Unlikely	Significant	Moderate	$ 2,642,799.60	$ 2,590,980.00	$ 2,720,529.00	Triangular
Estimate Risks								
ES-1	Estimate captures scope for all project features.	Likely	Significant	High	$ 2,590,980.00	$ 2,590,980.00	$ 2,850,078.00	Triangular
External Risks								
E-1	Stakeholders request late changes	Unlikely	Significant	Moderate	$ 2,590,980.00	$ 2,590,980.00	$ 2,850,078.00	Triangular
E-5	Unexpected escalation on key materials	Unlikely	Significant	Moderate	$ 2,202,333.00	$ 2,590,980.00	$ 3,497,823.00	Triangular
E-7	Acts of God (seismic events: volcanic activity, earthquakes, tsunamis; or severe weather: freezing, flooding or hurricane)	Likely	Marginal	Moderate	$ 2,590,980.00	$ 2,590,980.00	$ 2,720,529.00	Triangular

***Likelihood, Impact, and Risk Level to be verified through market research and analysis**

1. Risk/Opportunity identified with reference to the Risk Identification Checklist and through

2. Concerns and Discussions elaborate on Risk/Opportunity Events and includes any

3. The responsibility or POC is the entity responsible as the Subject Matter Expert (SME) for

4. Likelihood is measured as likelihood of impacting cost or schedule.

5. Impact is a measure of the event's effect on project objectives with relation to scope, cost,

6. Risk Level is the resultant of Likelihood and Impact Low, Moderate, or High. Refer to the matrix located at top of page.

7. Variance Distribution refers to the behavior of the individual risk item with respect to its

8. Correlation recognizes those risk events that may be related to one another. Care should be

9. Affected Project Component identifies the specific item of the project to which the risk directly

10. Project Implications identifies whether or not the risk item affects project cost, project

11. Results of the risk identification process are studied and further developed by the Cost

6.2 Cost Risk Contingency Results

The results of the CRA were generated by Crystal Ball are found in Table 2 and Figures 1 though 4.

Table 2. Crystal Ball Data and Results							
Minimum Likely Cost ($)	**Most Likely Cost ($)**	**Maximum Likely Cost ($)**	**Low**	**Likely**	**High**	**Percentiles**	**Forecast**
$2,331,882.00	$2,590,980.00	$3,109,176.00	$2,331,882.00	$2,590,980.00	$3,109,176.00	0%	2,302,767
$2,590,980.00	$2,590,980.00	$3,103,384.00	0	0	512,404	10%	3,126,173
$2,331,882.00	$2,590,980.00	$3,627,372.00	-259,098	0	1,036,392	20%	3,301,339
$2,590,980.00	$2,590,980.00	$3,109,176.00	0	0	518,196	30%	3,455,211
$2,569,406.00	$2,590,980.00	$2,645,404.00	-21,574	0	54,424	40%	3,572,314
$2,590,980.00	$2,590,980.00	$2,720,529.00	0	0	129,549	50%	3,695,451
$2,590,980.00	$2,590,980.00	$2,850,078.00	0	0	259,098	60%	3,817,506
$2,590,980.00	$2,590,980.00	$2,850,078.00	0	0	259,098	70%	3,955,670
$2,202,333.00	$2,590,980.00	$3,497,823.00	-388,647	0	906,843	**80%**	**4,110,994**
$2,590,980.00	$2,590,980.00	$2,720,529.00	0	0	129,549	90%	4,381,892
				2,590,980		100%	5,283,051
			Contingency =	**59%**			

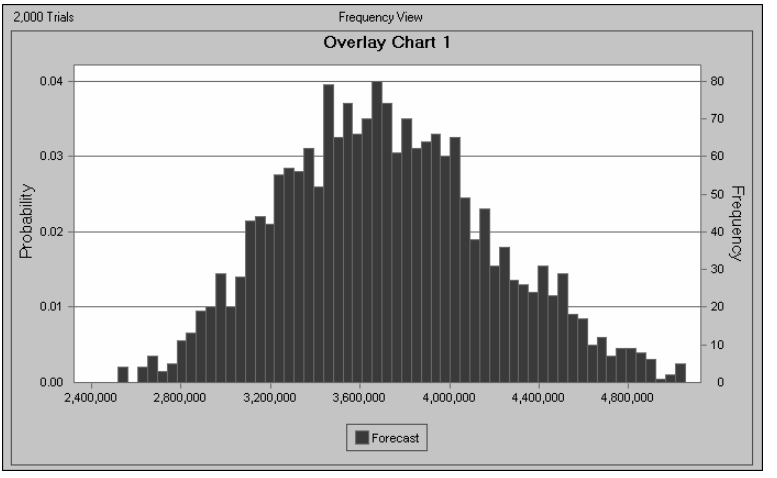


Figure 1. Frequency Results

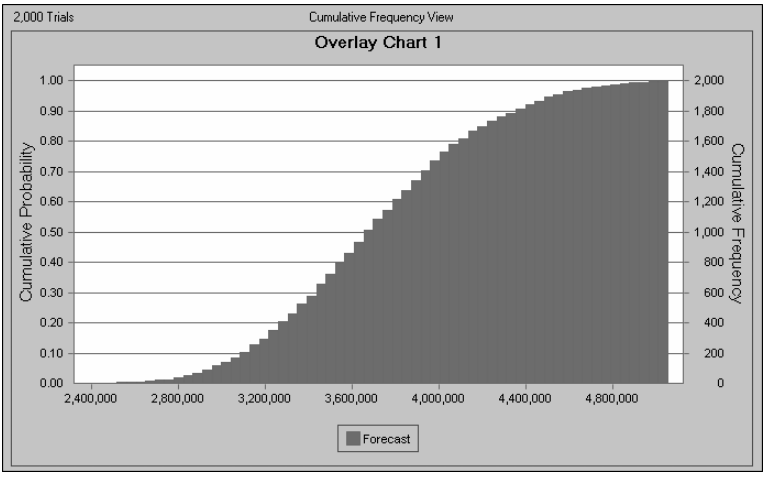


Figure 2. Cumulative Frequency Results

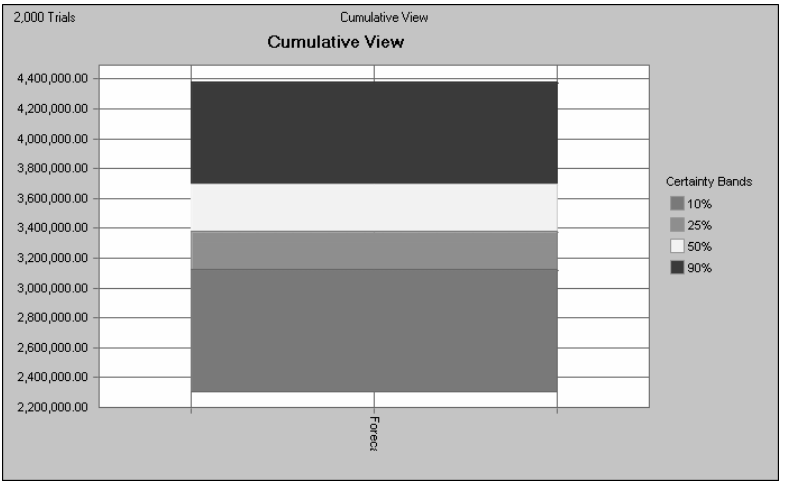


Figure 3. Cumulative Sensativity Results

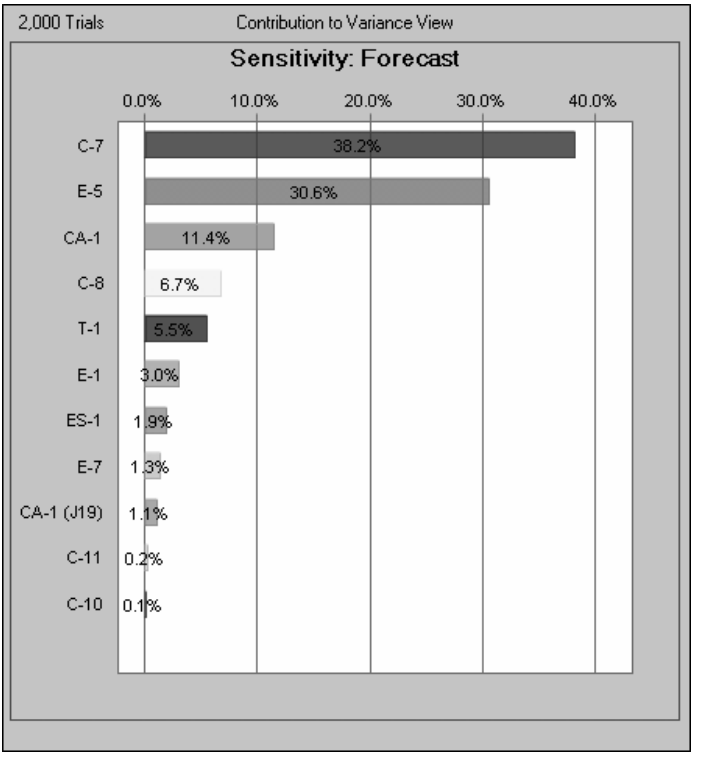


Figure 4. Sensativity Bar Chart

7. MAJOR FINDINGS/OBSERVATIONS

The CRA results presented a cost contingency of 59 percent at a confidence level of 80 percent. This contingency does not include escalation cost, which are to be applied within the Micro-Computer Aided Cost Estimating Software (MCACES) estimate for the recommended plan (Alternative 33) upon determination of the applicable contingency cost. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

8. MITIGATION RECOMMENDATIONS

Based on the findings of this analysis, a 59 percent contingency will be applied to the MCACES estimate for the recommended plan (Alternative 33). An Agency Technical Review will be performed in February, 2010 at which time comments will be addressed and the results of this analysis will be updated. The analysis performed by the CRA team, highlighted the potential risks inherent to the Amite River Diversion Canal Modification project. The results of this analysis not only help to quantify the financial risks involved with the recommended plan (Alternative 33), but they also allow the study and design team plan for these risks in an effort to mitigate the associated cost and schedule ramifications. Therefore, the following recommendations are suggested:

The scope of work for all portions of this project must be clearly defined, in an effort to minimize the chances of additional costs during construction and data analysis.

The scope should also be clearly defined during all aspects of cost analysis during the study portion of this project.

Additional emphasis needs to be placed on the plans and specifications portion of the project to ensure that the work is completed in a manor stipulated by the feasibility report and the design process.

All efforts must be made to ensure that an optimal amount of tree plantings associated with the construction of the project will succeed and therefore will not need to be replanted at a later time.

All issues involved with the mobilization and demobilization of this project must be well thought out during the plans and specifications portion of this project, due to the remote nature of the study area. This issue should also be heavily studied during the cost estimating phase of the feasibility study.

Additionally, adequate staging areas must be provided during construction to allow for the timely transport of equipment and personnel into and out of the construction site.

An emphasis must be placed on construction sequencing during the plans and specifications portion of the project to ensure the most efficient use of equipment and personnel possible during construction.

All efforts must be made to attract an adequate amount of bidders during the bidding process to ensure a competitive estimate is selected.

The appropriate estimations of weather disruptions must be made during the construction scheduling process to limit any additional cost that may result from prolonged work stoppages.

Section 11

SCHEDULE FOR DESIGN AND CONSTRUCTION

Design and Construction Schedule

A schedule will be developed for the required design, planning and construction needed for the LCA-ARDC Modification project once a signed Chief's Report is obtained in December, 2010. It was assumed that these processes would begin in January 2011. The schedule includes the following items:

- **Plans & Specifications.** This would involve the design phase of the project in which a formalized plans and specifications package is produced for any contractor willing to bid on the construction phase of the project. It is estimated that this process would take approximately a year.

- **Contract Acquisition.** This process would include the development of a contract for construction as well as the bidding and selection process. It is estimated that this process would take approximately three months.

- **Construction (Earthwork).** This represents the portion of construction required for construction of the bank openings and the bifurcated conveyance channels. This would also include any necessary mobilization and demobilization. Vegetative plantings are not included in this portion of the schedule. This process is estimated to take approximately six months.

- **Site Assessment/Planting Survival Assessment.** Upon completion of the earthmoving phase of construction a period of no activity would to take place to allow for evaluations of existing vegetative conditions, before vegetative plantings may commence. This allows for time to develop the scope of plantings, acquire the needed plants and seedlings for planting, and to allow the placed dredged material to settle. A similar assessment phase will be entered approximately 8 months after the first planting has been completed.

- **Vegetative Planting Contract Acquisition.** This process would include the development of a contract for vegetative plantings as well as the bidding and selection process. It is estimated that this process would take approximately three months. This process would most-likely be initiated twice, once for the initial plantings and a few years later for the secondary plantings.

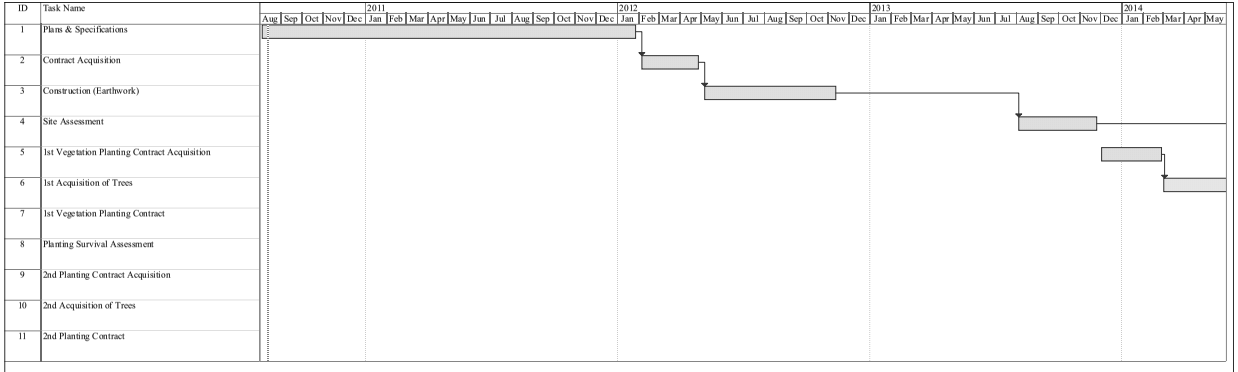
- **Primary and Secondary Planting Contracts.** This process is composed of the initial and the secondary plantings of seedlings and potted plants in the designated areas of the project footprint. This includes mobilization and demobilization, planting, and the installation of nutria guards on each plant. It is estimated that this process would take approximately 12 months.

Table 1. Earthmoving Schedule

ARDC Alternative 39 Earthmoving Construction Schedule												
		Dredged Material Berm			Swamp		Equipment Utilized (Hours)					
Week*	Mob	Clear Trees	Land-Based Earthwork	Marsh Backhoe Work	Clear Trees	Marsh Backhoe Work	Log Skidder	D6 Dozer	Marsh Backhoe	Barge	Tug Boat 900hp	Crew Boat**
NTP												
2	MOB											40
3							40	40	80	40	40	40
4		Cut 1					40	40	80	40		40
5				Cut 1			40	40	80	40		40
6			Cut 1		Cut 1		40	40	80	40	20	40
7		Cut 2					40	40	80	40		40
8							40	40	80	40		40
9			Cut 2		Cut 2		40	40	80	40	20	40
10		Cut 3				Cut 1	40	40	80	40		40
11				Cut 2			40	40	80	40		40
12			Cut 3		Cut 3		40	40	80	40	20	40
13		Cut 4					40	40	80	40		40
14							40	40	80	40		40
15			Cut 4		Cut 4		40	40	80	40	20	40
16		Cut 5					40	40	80	40		40
17							40	40	80	40		40
18			Cut 5		Cut 5	Cut 2	40	40	80	40	20	40
19				Cut 3			40	40	80	40		40
20									80	40		40
21									80	40		40
22									80	40		40
23									80	40		40
24									80	40		40
25									80	40		40
26						Cut 3			80	40	20	40
27				Cut 4					80	40		40
28									80	40		40
29									80	40		40
30									80	40		40
31									80	40		40
32									80	40		40
33									80	40		40
34						Cut 4			80	40	20	40
35				Cut 5					80	40		40
36									80	40		40
37									80	40		40
38									80	40		40
39									80	40		40
40									80	40		40
41									80	40		40
42						Cut 5			80	40		40
43	Demob								80	40	40	40
						Totals	**680**	**680**	**3,280**	**1,640**	**220**	**1680**

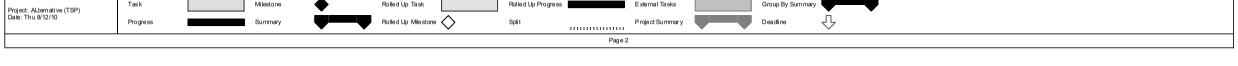
* Cells are completion by end of specific week

** Contingency Hours Added for Repairs Ect.


ID
Task Name
2011
2012
2013
2014
Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May
1 Plans & Specifications
2 Contract Acquisition
3 Construction (Earthwork)
4 Site Assessment
5 1st Vegetation Planting Contract Acquisition
6 1st Acquisition of Trees
7 1st Vegetation Planting Contract
8 Planting Survival Assessment
9 2nd Planting Contract Acquisition
10 2nd Acquisition of Trees
11 2nd Planting Contract


Project: Alternative (TSP)
Date: Thu 8/12/10
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Page 1


ID
Task Name
2015
2016
2017
2018
Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
1 Plans & Specifications
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Project: Alternative (TSP)
Date: Thu 8/12/10
Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline
Page 2

Section 12

RELOCATIONS

Relocations

No relocations of infrastructure or public services, such as water service and/or electrical service are needed for construction of the Tentatively Selected Plan (Alternative 33).

Appendix M

HTRW REPORT

October 12, 2009

PHASE I
ENVIRONMENTAL SITE ASSESSMENT

Louisiana Coastal Area
Amite River Diversion Canal (ARDC)
Modification

Prepared for

U.S. Army Corps of Engineers
New Orleans District
New Orleans, Louisiana

Coastal Protection and Restoration
Authority of Louisiana
Baton Rouge, Louisiana

Contract No. 2503-07-13
Task Order No. 08
GEC Project No. 27850108

Prepared by

Gulf Engineers & Consultants
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Baton Rouge, Louisiana
Telephone: (225) 612-3000

FULL REPORT IS AVAILABLE UPON REQUEST

1.0 SUMMARY

On behalf of the Louisiana Office of Coastal Protection and Restoration (OCPR) and the U.S. Army Corps of Engineers – New Orleans District (USACE), G.E.C., Inc. (GEC) has completed a Phase I Environmental Site Assessment (ESA) for the Louisiana Coastal Area Amite River Diversion Canal (ARDC) Modification project. The ARDC Modification project is a restoration project that proposes construction of gaps in the existing dredged material spoil banks of the ARDC to allow drainage of the Maurepas Swamp during low-water periods and the introduction of floodwaters during high-water periods. For the purposes of this ESA, the *project area* includes 18.12 square miles situated along the ARDC in Ascension and Livingston parishes, in the vicinity of Head of Island, Louisiana.

The OCPR contracted GEC to conduct an ESA of the project area in accordance with USACE Regulation ER 1165-2-132, *Water Resources Policies and Authorities for Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works Projects, 26 June 1992* and the American Society for Testing and Materials (ASTM) Standard E 2247-08 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property* in order to identify recognized environmental conditions (REC) located on, or in the vicinity of, the project area. The ESA is formatted in accordance with ASTM guidance, and encompasses the required elements of ER 1165-2-132 within the ASTM format.

In order to characterize environmental conditions for the project area, GEC:

- Reviewed Federal, state, and local environmental databases;
- Conducted historical research;
- Interviewed pertinent personnel; and
- Performed a site investigation.

GEC performed this Phase I ESA in accordance with the scope and limitations of ASTM E 2247-08. Any exceptions to, or departures from, this practice are described in the report. Based on the review of Federal, state, and local environmental databases, historical research, interviews, and site investigations, the assessment identified two RECs that may have adversely impacted, or may potentially impact, environmental conditions in the project area:

- USTs at the former Chinquapin Grocery, and
- an AST at Val's Marina.

FOR CONTINUATION OF HOUSE DOCUMENT 112-43
RECOMMENDATIONS FOR THE IMPLEMENTATION
OF FOUR PROJECTS
SEE VOLUME III