ENVIRONMENTAL ASSESSMENT

for

ROCKEFELLER REFUGE GULF SHORELINE STABILIZATION CWPPRA PROJECT ME-18 Cameron Parish, Louisiana

U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

NATIONAL MARINE FISHERIES SERVICE
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This plan is prepared under the guidance of the National Oceanic and Atmospheric Administration (NOAA), in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) Regulations on implementing NEPA (40 Code of Federal Regulations 1500-1508).

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CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
G/CS	Gravel/Crushed Stone
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LWA	Lightweight Aggregate
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries Service	National Marine Fisheries Service
NRCS	U.S. Department of Agriculture, National Resources Conservation Service
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Department of Interior, Fish and Wildlife Service

LIST OF ABBREVIATIONS

%	percent
$	U.S. dollars
°F	degrees Fahrenheit
ft	feet
km	kilometers
msl	mean sea level
ppt	parts per thousand
psf	pounds per square foot
yr	year

1.0 Introduction

This Environmental Assessment (EA) evaluates the impacts of activities to stabilize and protect coastal wetlands in southwestern Louisiana along the Gulf of Mexico shore, as shown in Figure 1. The project is referred to as the Rockefeller Refuge Gulf Shoreline Stabilization Project, ME-18. The National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NOAA Fisheries Service) is responsible for the implementation of this project, in coordination with the State of Louisiana, under the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) of 1990 (16 U.S.C. §§ 777c, 3951-3956). This responsibility includes conducting the evaluation and other activities involved for final decision-making in compliance with the National Environmental Policy Act (NEPA) of 1969. To meet NEPA compliance requirements, an environmental evaluation must be conducted to determine the potential of federally funded projects to cause negative environmental impacts. This report documents the results of such an evaluation for the Rockefeller Refuge Gulf Shoreline Stabilization Project.

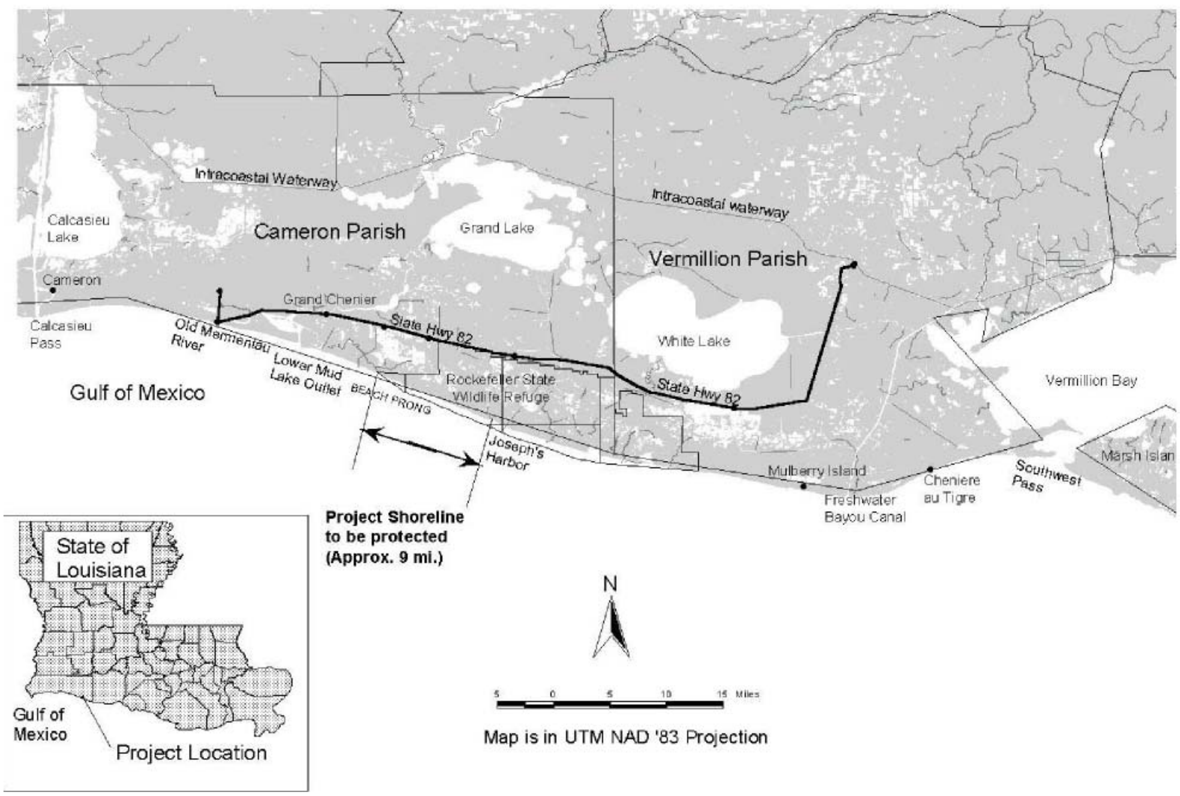

Figure 1
Rockefeller Refuge Gulf Shoreline Stabilization Project Location Map
(Figure taken from Shiner Moseley and Associates, Inc., 2005)

In accordance with the CWPPRA, five Federal agencies and the State of Louisiana comprise a Task Force to "implement a comprehensive approach to restore and prevent the loss of coastal wetlands in Louisiana" (16 U.S. C. § 3952(b) (2)). The Federal agencies involved are: the U.S. Army Corps of Engineers (USACE); the U.S. Department of Commerce, NOAA Fisheries Service; the U.S. Department of Interior, Fish and Wildlife

Service (USFWS); the U.S. Department of Agriculture, National Resources Conservation Service (NRCS); and the U.S. Environmental Protection Agency (EPA). These agencies held public forums in coastal areas of Louisiana to determine wetland problems. Subsequently, comprehensive restoration and protection plans for solutions were developed, including the proposed project (Louisiana Coastal Wetlands Conservation and Restoration Task Force, 1993). This project was on the Eleventh Priority Project List, approved by the CWPPRA Task Force in May 2001.

1.1 Project Funding

The project is funded and authorized for engineering and design in accordance with the provision of the Coastal Wetlands Planning, Protection, and Restoration Act, as discussed above. The CWPPRA is providing 85 percent of the funding for this project, with 15 percent of the cost share being provided by the State of Louisiana Department of Natural Resources (LDNR).

1.2 Project Location

The proposed project area is 1,373 acres located within the Rockefeller Wildlife Management Area and Game Preserve (Rockefeller Refuge) along the Gulf shoreline from Beach Prong to Joseph Harbor in Cameron Parish, Louisiana, as shown in Figures 1 and 2. The center of the project area is located at the approximate coordinates of 30º 08’ 00” N latitude and 092º 45’ 00” W longitude. The refuge is owned and maintained by the State of Louisiana, Louisiana Department of Wildlife and Fisheries (LDWF).

Rockefeller Refuge is located in southwestern Louisiana, approximately 45 miles southeast of Lake Charles, Louisiana and 50 miles southwest of Lafayette, Louisiana. It is bounded to the north by Louisiana Highway 82 and on the south by the Gulf of Mexico. The east boundary follows the section line between R1W and R2W, which is due south from the north end of Pecan Island. The west boundary follows the section line between R4W and R5W and T16S and then follows a line westward to the Gulf. The refuge falls in the southeast corner of Cameron Parish and the remainder in the southwest corner of Vermilion Parish.

For purposes of clarity throughout this document, the Rockefeller Refuge Gulf Shoreline Stabilization Project will be referred to as the project or the project area.

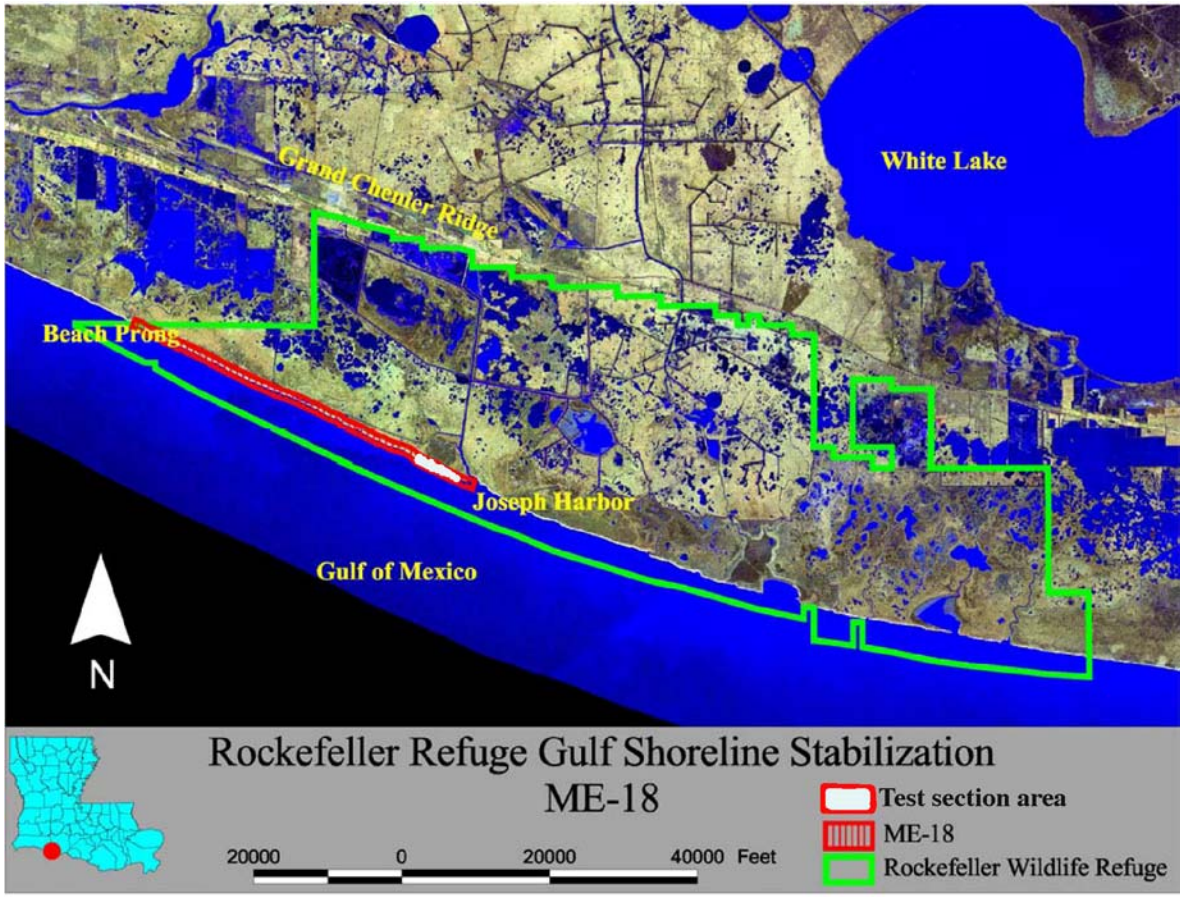

Figure 2
Rockefeller Refuge Boundaries and Gulf Shoreline Stabilization Project Area

2.0 Purpose of and Need for the Proposed Action

2.1 Purpose

The goal of the CWPPRA is to "restore and prevent the loss of coastal wetlands in Louisiana." The primary goal of this project is to (1) halt Gulf shoreline retreat and direct marsh loss from Beach Prong to Joseph Harbor over the 20-year life of the project. Additional goals are (2) to protect saline marsh habitat, and (3) enhance fish and wildlife habitat.

2.2 Need for Action

Currently 25 to 35 square miles of wetlands are lost each year along coastal Louisiana. Shoreline erosion results in both direct loss of land and indirect wetland loss by exposing wetlands to Gulf water. The Rockefeller Refuge has experienced high rates of marsh breakup and shoreline erosion over the past 50 years because of man-made and natural processes. When deeded to the state, the refuge encompassed approximately 86,000 acres. However, beach erosion has taken a heavy toll, and the most recent surveys indicate only 76,042 acres remaining (http://www.wlf.state.la.us/).

The average long-term shoreline erosion rate in the project area is estimated to be 30.9 ft/yr (Connor et al. 2004). Recent land loss rates are estimated at 57 acres/yr (Shiner Moseley and Associates, Inc., 2005). Storms can create short-term rates that are much larger than this. For example, in 1998, Tropical Storm Frances caused an estimated 60-65 ft of erosion along this stretch during a four day period according to anecdotal information. Intertidal marshes are among the most productive ecosystems on earth and their rapid disappearance may significantly impact the economy of South Louisiana. Action is needed therefore to provide immediate protection to existing wetlands. The importance of these wetlands to the physical, biological, and cultural resources of the area is discussed in Chapter 4.0.

3.0 Alternatives and Proposed Action

3.1 Alternatives Considered and Rejected

Through a contract with LDNR, Shiner Moseley and Associates, Inc. (Shiner Moseley) is responsible for the design of the project. All engineering and design information presented herein has been taken directly or paraphrased from the 95% Design Report (Shiner Moseley and Associates, Inc., 2005).

During the Feasibility Study conducted by Shiner Moseley, potential project alternatives were evaluated based on their ability to meet the following criteria:

- Prevent beach erosion for up to Category 1 hurricane conditions, which were estimated to have a return interval of about 10 years at the project site.
- Be designed, constructed, monitored, and maintained over a 20-year design life within a specified budget.

In addition to the criteria stated above, where practicable, the protection should remain stable for more severe storm conditions up to a 100-year event. To find a shore protection alternative that would meet these criteria, an alternatives identification and evaluation was performed. The low bearing capacity of the soils severely limited the type of shoreline protection that could be built and provide the desired protection. Over 80 alternatives and variations of alternatives were considered by Shiner Moseley.

The initial screening of these alternatives reduced the number of possible alternatives to 14. Design, cost, and construction considerations for these 14 alternatives were then evaluated in more detail. As described extensively in Shiner Moseley's Feasibility Study report, most of the alternatives were eliminated based on cost and/or the bearing pressure being too great for the soil. After final screening, only two alternatives were recommended for further consideration. Because of the unique conditions along the Refuge, the innovative nature of the proposed alternatives, and the lack of definitive design methodology, test sections were proposed for further evaluation.

In December 2003, subsequent to submittal of the final Feasibility Study report and decision to implement test sections, modified design criteria were considered to allow evaluation of additional alternatives. Under the modified design criteria, an increase of the construction budget by 50 percent and relaxation of the "no erosion under a Category 1 hurricane" requirement were considered. This assessment included screening of nine additional alternatives. Following this additional screening, a third approach consisting of soil pre-loading for later construction of a breakwater or revetment was also selected for further analysis. However, due to the large degree of uncertainty involved in stacking the stiff clay and the high cost of subsequent armoring, the soil pre-loading alternative was removed from consideration.

Two more alternatives that were previously eliminated during the Feasibility Study, due to cost, were selected for further evaluation in December of 2003: gravel/crushed stone (G/CS) beach fill and a reef breakwater combined with G/CS beach fill. Adding these alternatives brought the total number of alternatives for further evaluation to four, plus the "No Action" alternative.

3.2 Final Alternatives and Proposed Action

Alternatives identified and considered for the proposed construction and associated impacts in the 95% Design Report for the project include: (1) No Action, (2) Beach Fill with gravel/crushed stone, (3) Reef Breakwater with sand or gravel/crushed stone beach fill, (4) Reef Breakwater with lightweight aggregate (LWA) core, and (5) Concrete Panel Breakwater. Selection of the alternatives was based on wave field data, soil bearing capacity, protection criteria, and budget. The preferred alternative (alternative 6) proposes construction of prototypes of alternatives 2, 3, 4 and 5 above for the purpose of identifying the alternative to be implemented for the full 9.2 mile project.

3.2.1 Alternative 1 – No Action

The No Action alternative considers taking no action to protect the shoreline in the project area. The No Action alternative would fail to protect the beach and shell berm, thus allowing continued erosion caused by normal wave energy and hurricane events. The No Action alternative would also fail to protect the valuable marshes beyond the beach north to Louisiana Highway 82. These marshes provide habitat for numerous commercially and recreationally important aquatic and terrestrial species. With the loss of vegetative habitats, there would be a continued decline in nursery and forage areas that provide much of the food that comprises the basis of the food web. Without providing protection and wave dampening along the existing beach, the saline waters of the Gulf would be allowed to encroach into the brackish and freshwater marshes to the north. The increased salinities would compromise the intensive water management techniques currently used for the eleven impoundments found on the refuge.

Since 1954, the Rockefeller Refuge has been the test site for various marsh management strategies, including levees, weirs, and several types of water control structures to enhance marsh health and waterfowl food production. The basic management philosophy utilized at the Rockefeller Refuge is to stabilize water levels and reduce salinities to encourage growth of submerged aquatics and, in the fresher units, encourage the production of annual emergents. A No Action alternative would compromise this basic management philosophy.

West of the project area, in the Constance Beach area, shoreline erosion has led to the exposure of Louisiana Highway 82 to Gulf waves. The highway has been severely damaged during several winter and tropical storms. For this reason, it has been moved further landward several times, and is presently built on the last landward natural ridge (chenier). Louisiana Highway 82 is the only hurricane evacuation route out of the area. If the beach and interior marshes are not protected at the Rockefeller Refuge, eventually erosion will occur in the project area exposing more of the Louisiana Highway 82 evacuation route to damage.

3.2.2 Alternative 2 – Beach Fill with Gravel/Crushed Stone

Alternative 2 would consist of adding G/CS to the existing soft clay shoreline along the entire 9.2 miles of the project area. The design includes constructing a 70 ft wide berm at an elevation of +2.0 ft NAVD88 and a 30 ft “backstop” at an elevation of +6.0 ft NAVD88, as shown in Figure 3. Constructed slopes would be 10:1. It is predicted that settlement and wave action modification would result in final elevations of +0.7 ft for the berm and +3.9 ft for the "backstop" with the submerged berm reaching equilibrium at a width of approximately 65 ft and a slope of approximately 12:1.

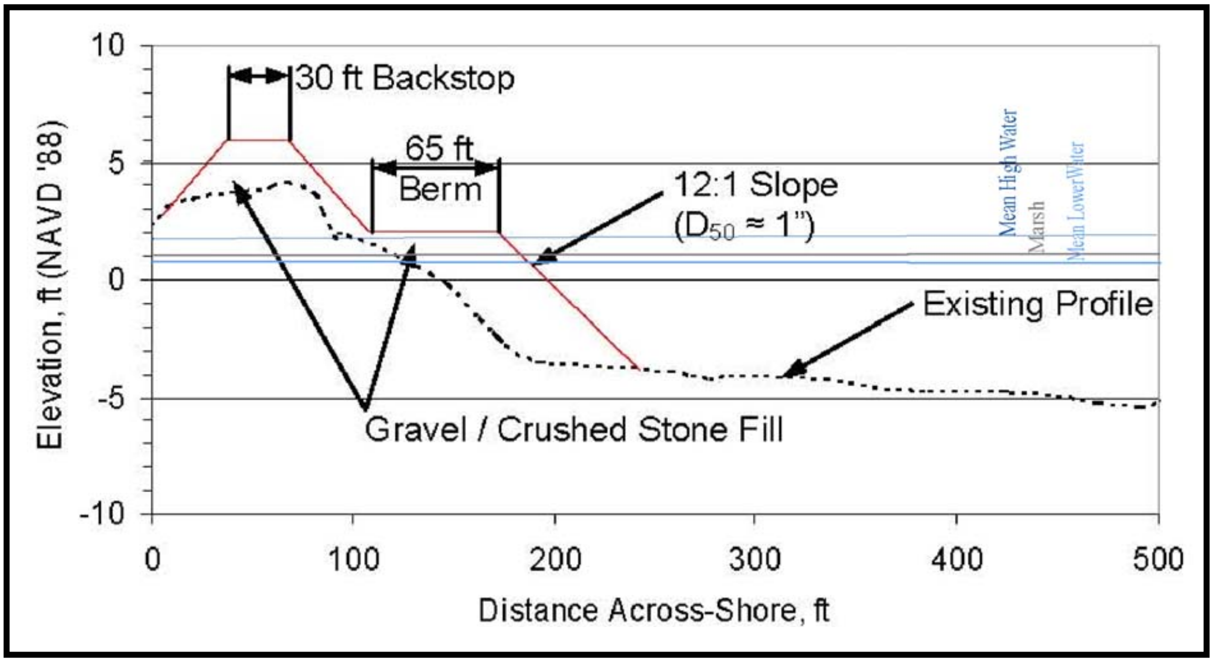

Figure 3
Typical Section of Gravel/Crushed Stone Beach Fill Alternative

Alternative 2 has been successful in other projects, however there is no known application of this method on soft clay beaches (Shiner Moseley and Associates, Inc., 2005).

3.2.3 Alternative 3 – Reef Breakwater with Gravel/Crushed Stone Beach Fill

Alternative 3 would consist of constructing a reef breakwater, as shown in Figure 4, along the entire 9.2 miles of the project area. A conventional rock breakwater has been determined not to be feasible at the project site due to the soft soils being unable to support the relatively large bearing capacity. As an alternative, a rock reef breakwater is proposed. Reef breakwaters are rubble mounds of rock, with sizes similar to that found in the armor and/or first underlayer of conventional breakwaters. These are not constructed with underlayers or a core of smaller stone, and are broad crested in comparison to conventional breakwaters. Although reef breakwaters are lower than conventional breakwaters, the broader crests are designed to decrease the wave energy impacting the shoreline by breaking and attenuating the waves, but still allow some wave transmission under typical conditions. The reef breakwater, constructed from graded riprap, would be located near the approximate –4 ft contour line or approximately 150 ft offshore. Breakwater crest width is proposed to be approximately 24 ft at an elevation of +1.0 ft, which is expected to settle to +0.0 ft.

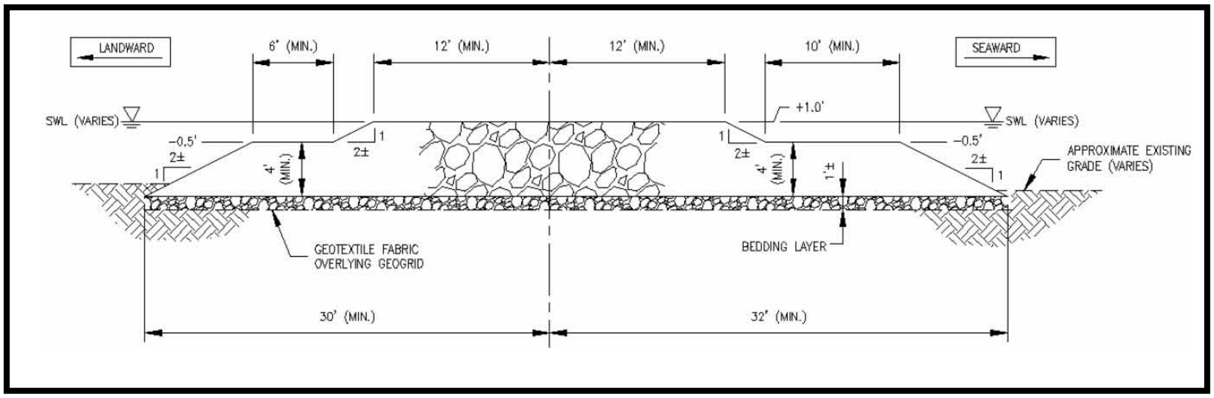

Figure 4
Typical Section of Reef Breakwater

Landward of the breakwater, additional protection to the existing shoreline would be increased by adding G/CS beach fill. The proposed beach fill material will be G/CS (sand was evaluated and removed from consideration due to its instability following profile equilibration). The G/CS beach fill would be constructed in the same manner as the previously mentioned Alternative 2. This fill method is expected to intersect near the toe of the reef breakwater, as shown in Figure 5.

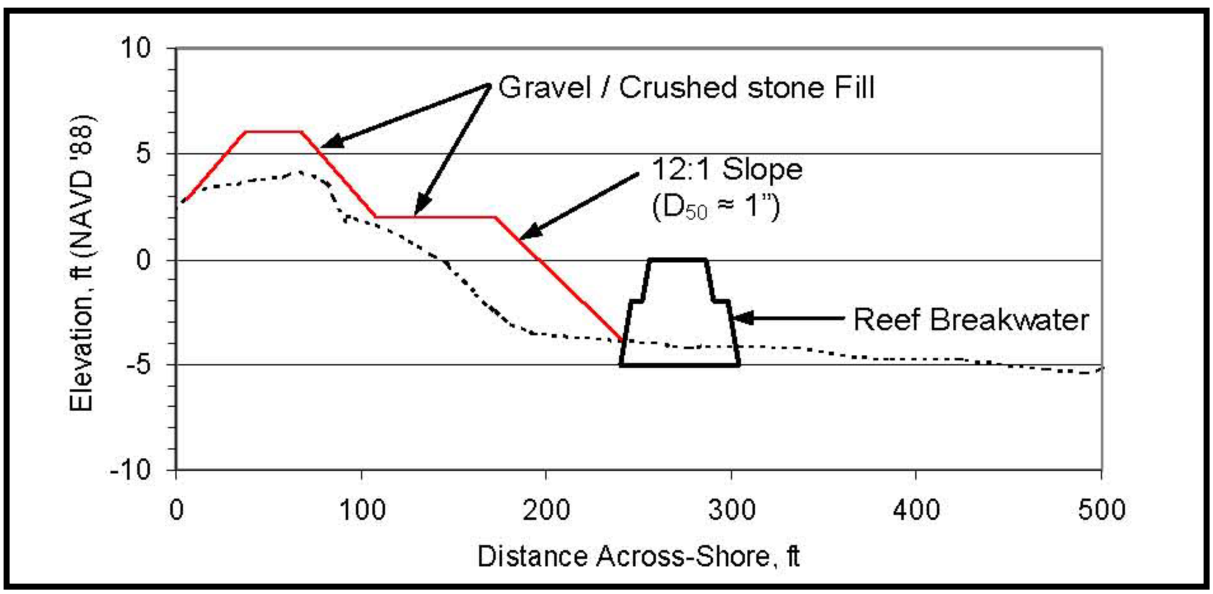

Figure 5
Typical Section of Reef Breakwater with Gravel/Crushed Stone Beach Fill Alternative

3.2.4 Alternative 4 – Reef Breakwater with Lightweight Aggregate Core

Alternative 4, as shown in Figure 6, would consist of constructing a reef breakwater with a LWA core replacing the rock core of the structure. The LWA is an encapsulated lightweight expanded shale or clay product that is almost neutrally buoyant, decreasing the bearing pressure and allowing greater crest elevations and increased wave attenuation. The greater crest elevation is intended to eliminate the need for secondary protection via beach fill as provided in the previous reef breakwater alternative (Alternative 3). A secondary benefit of the LWA core is lower permeability and less wave transmission through the structure, although armor stone stability may decrease with decreased permeability. This alternative would also be installed along the entire 9.2 miles of the project.

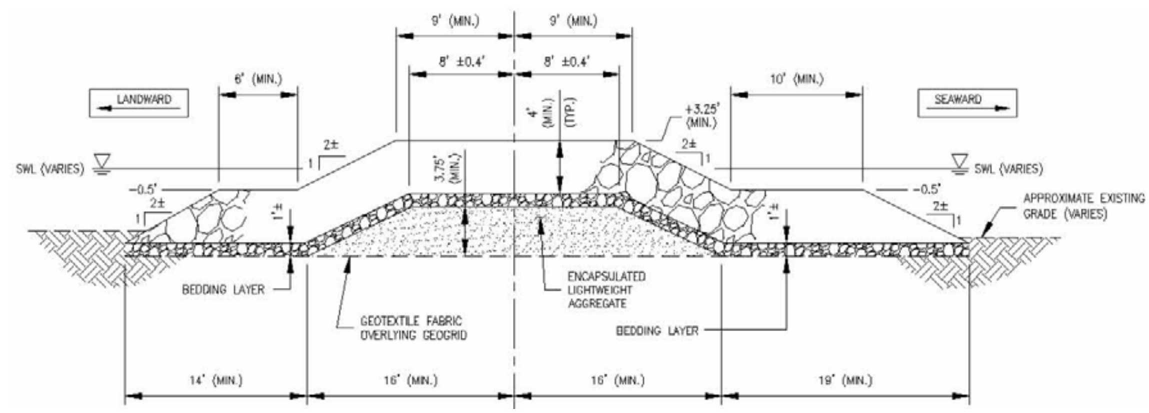

Figure 6
Typical Section of Reef Breakwater with Lightweight Aggregate Core Alternative

Reef breakwaters with LWA cores have been applied on soft clay soils in limited wave exposure areas at recent projects in Louisiana, but no information has been identified on such structures being constructed in a more aggressive wave climate. A potential weakness of this alternative is that armor stone placed on the LWA core may not be stable when impacted with larger waves from the open Gulf of Mexico.

As with Alternative 3 and all other breakwater alternatives (Alternative 5, below), the reef breakwater with LWA core would be located along the approximate -4 ft contour, approximately 150 ft offshore. The design calls for a LWA core, approximately 3.75 ft high, to be initially covered by 4 ft of armor stone, resulting in an initial crest elevation of +3.25 ft. It is predicted that structure settlement would lower the crest elevation to approximately +1.9 ft over a time period of several decades. The structure would have a crest width of 18 ft and an elevation of approximately +1.9 ft NAVD88 following structure settlement. Mean high water level is +1.8 ft NAVD88.

3.2.5 Alternative 5 – Concrete Panel Breakwater

Alternative 5 consists of the construction of a concrete panel breakwater, as shown on Figures 7 and 8, along the entire 9.2 miles of the project area. This would involve a pre-cast concrete cap on steel sheet piles in contiguous panels approximately 40 ft long. There would be three 10 ft long portions of the panel exposed to the waves and two 5 ft gaps that would allow waves to pass. These panels would be prefabricated on-shore and brought to the site and set on two concrete piles that would be driven to deeper firm clays. This would prevent settlement of the panels. A portion of the upper very soft clays would be replaced with sand to provide sufficient lateral resistance. The sand would be covered by armor rock. To provide maximum wave dampening in 1 yr and 10 yr storm events, the concrete panels would be placed to a +5 NAVD88 elevation.

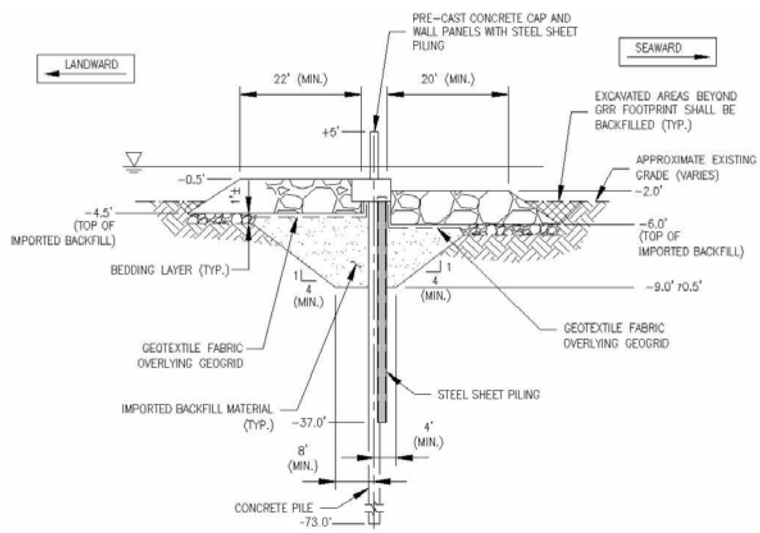

Figure 7
Typical Section of Concrete Panel Breakwater Alternative

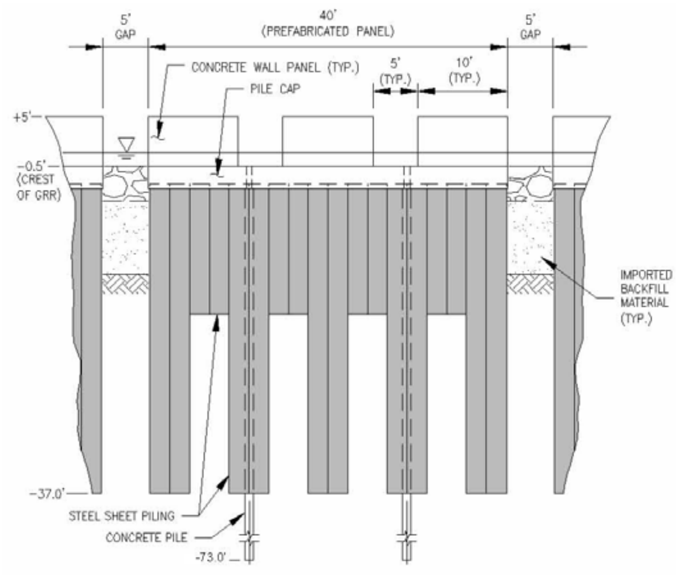

Figure 8
Typical Elevation of Concrete Panel Breakwater Alternative

3.2.6 Proposed Alternative 6 - Test Sections (Preferred Alternative)

Construction of prototype test installations for Alternatives 2, 3, 4 and 5 (beach fill with gravel/crushed stone; reef breakwater with sand or gravel/crushed stone beach fill; reef breakwater with lightweight aggregate core; and concrete panel breakwater, respectively) is proposed and would allow detailed evaluation and comparison of each alternative in terms of constructability, ability to deal with the soft soils, wave attenuation, shoreline response, cost, maintenance requirements, and aesthetics. Evaluation of the test installations would serve as the basis for implementation of the full 9.2 mile project. In designing the layout of the testing program, the following two primary factors were considered:

1. To the extent practicable, each test section needs to be long enough to infer valid conclusions regarding performance of a full 9.2 mile project. Performance will be evaluated in terms of constructability, settlement, structural stability, wave attenuation, shoreline and beach profile response, aesthetics, and other factors.
2. To the extent practicable, the test sections should have enough separation such that they do not influence each other and can be evaluated discretely.

From a realistic standpoint, perfect representation of the full 9.2 mile project can not be achieved regardless of the test layout due to the significantly lesser lengths of the test installations and shorter evaluation period.

At a minimum, Shiner Moseley recommended that the test installations be monitored for one year to allow exposure to a full range of seasonal conditions. However, they noted that even over one year, the variability in shoreline change could influence evaluation of how the shoreline responds to the test installations. In addition to the difficulties associated with shoreline change, evaluating settlement could be difficult since total soil consolidation is expected to occur over a period of decades, with only approximately 10% occurring over the first 6 to 12 months.

The location of the testing program was selected to be at the eastern end of the 9.2 mile project area a minimum of 2,000 ft from Joseph Harbor. This location was selected to offer Joseph Harbor as a possible offloading point and shelter from waves for construction contractors. A minimum offset of 2,000 ft was selected to minimize the potential influence of the inlet on the test installations. The proposed layout for the testing program is provided in Figure 9 and affects a total of 0.56 miles along the shoreline. Specific design issues that served as the basis and rationale for the layout are provided in the 95% Design Report (Shiner Moseley and Associates, Inc., 2005).

In recognition of the effects of longshore material transport on the terminal ends of beach armoring systems, analyses were performed to determine the shortest possible test section length where the center of the test section would most likely not be affected by longshore transport to more closely represent a full-scale project, where the effects on the two terminal ends of the 9.2 mile project would be minimally consequential. Based on this analysis, Shiner Moseley recommended that the two beach fill alternatives be joined to create a continuous 1,200 ft fill test section with a terminal groin at each end (Figure 9). The reef breakwater with G/CS beach fill (Alternative 3) would be located within the eastern 500 ft of the fill area, with the remaining 700 ft being unprotected fill (Alternative 2), as shown on Figure 9. Given that impacts of wave diffraction from the reef breakwater are expected to be limited to an area within 150 ft of its west end, the center 200 ft of the fill area can be applied as a buffer that separates the two fill alternatives.

The terminal groins would be constructed of rock similar to that being placed for the reef breakwaters or of gabions filled with the beach fill material. However, the crest of the groins would not be much higher than the beach fill due to the limited bearing capacity of the underlying clay. As a result, some fill is likely to be transported over the groins. In addition, the groins would not extend far enough offshore to completely prevent transport of fill around their ends. To reduce the risk of transport of escaped fill material into adjacent test areas, the fill alternatives are located to the west (net downdrift) of the other two alternatives (Alternatives 4 and 5), as shown on Figure 9 and described below.

The reef breakwater with LWA core (Alternative 4) and concrete panel breakwater (Alternative 5) test sections would be constructed in 500 ft sections, with a 750 ft open water buffer between them (Figure 9). The test sections would be constructed 2,700 ft to the east of the beach fill alternative test sections to provide a buffer, as described above.

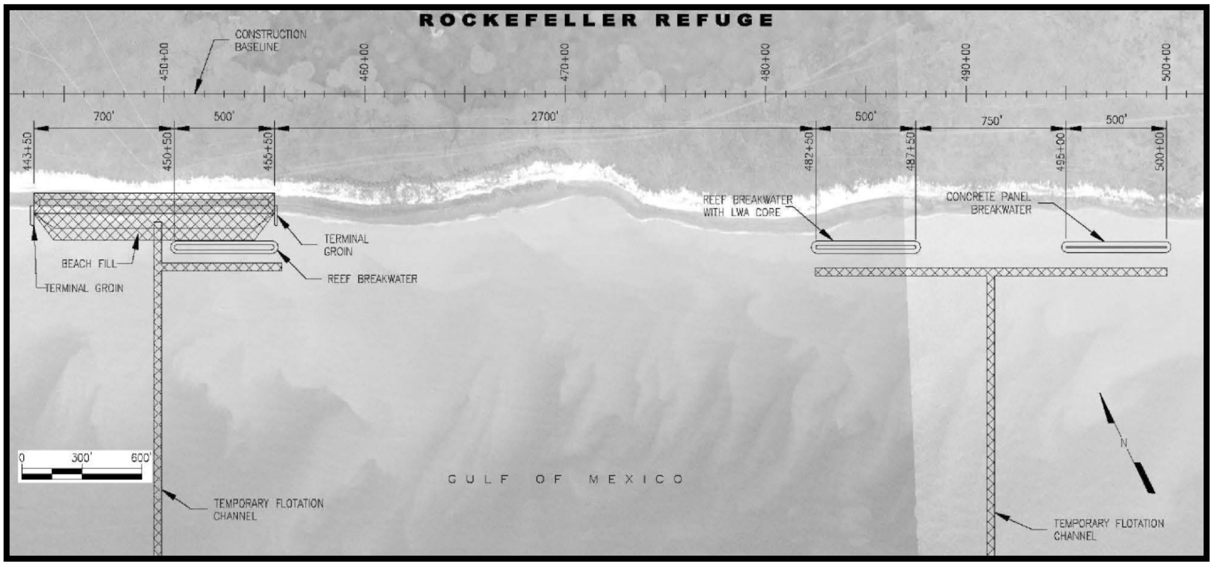

Figure 9
Layout of Testing Program (Proposed Alternative)

Per the request of the land managers and the State of Louisiana, Department of Wildlife & Fisheries, at the conclusion of the test section evaluation period all of the G/CS components of the test sections would be removed and the affected areas returned as near as possible to their pre-construction conditions, as explained on pages 5-20 thru 5-26 of the Shiner Moseley 95% Design Report (2005).

4.0 Affected Environment

This section contains a description of the existing environment of the project located at Rockefeller Wildlife Refuge. It provides information to serve as a baseline from which to identify and evaluate environmental consequences resulting from the proposed action. Resources evaluated are presented in three major categories, which represent major environmental components of the area: physical, biological, and cultural. The total project area is approximately 1,373 acres (863 acres of saline marsh and 510 acres of open water). The test section area includes approximately 7 acres of marsh and open water.

4.1 Physical Environment

4.1.1 Geology, Soils, and Topography

Rapid coastal retreat occurs on most of Louisiana’s shoreline (e.g., Gagliano et al. 1981; Penland and Ramsey, 1990; Penland et al. 1990; Westphal et al.1991; Williams 1994) due to subsidence and compaction of the deltaic plain, eustatic sea-level rise, and human activity that reduces sediment delivery to the delta.

The Mississippi River alluvial valley predominates Southwest Louisiana geology (Russell, 1940). The recent development of the Atchafalaya River as the most recent Mississippi River distributary and prominent sediment source has resulted in a young sedimentary system dominated by fine-grained sedimentary processes. The Chenier plain, in which the project is located, begins approximately 80 km west of the Atchafalaya River outlet and is approximately 200 km long. Shore-parallel ‘‘chenier’’ ridges 3 to 10 ft high composed of coarse sand and shells alternate with marshes that represent relict mudflat zones (Draut et al. 2005; Gould and McFarlan, 1959; Byrne et al. 1959; Beall, 1968; Hoyt, 1969; Otvos and Price, 1979). This shoreline began to develop approximately 3,000 years ago (Gould and McFarlan, 1959) as mudflats prograded when the Mississippi River delivered sediment to the western edge of its delta complex. When the Lafourche deltaic lobe was abandoned in favor of the Mississippi’s modern course, accretion on the Chenier plain ceased and the youngest chenier ridges formed as reworked sediments and shell debris were concentrated into the ridges (i.e., cheniers) that separate marsh zones (Draut et al. 2005; Gould and McFarlan, 1959; Penland and Suter, 1989; Augustinius, 1989). Modern accretion due to Atchafalaya sediment delivery occurs seaward of these youngest chenier ridges (Figure 10). In this prograding area, the shore consists of a very broad mud flat, colonized by smooth cordgrass on slightly elevated ridges.

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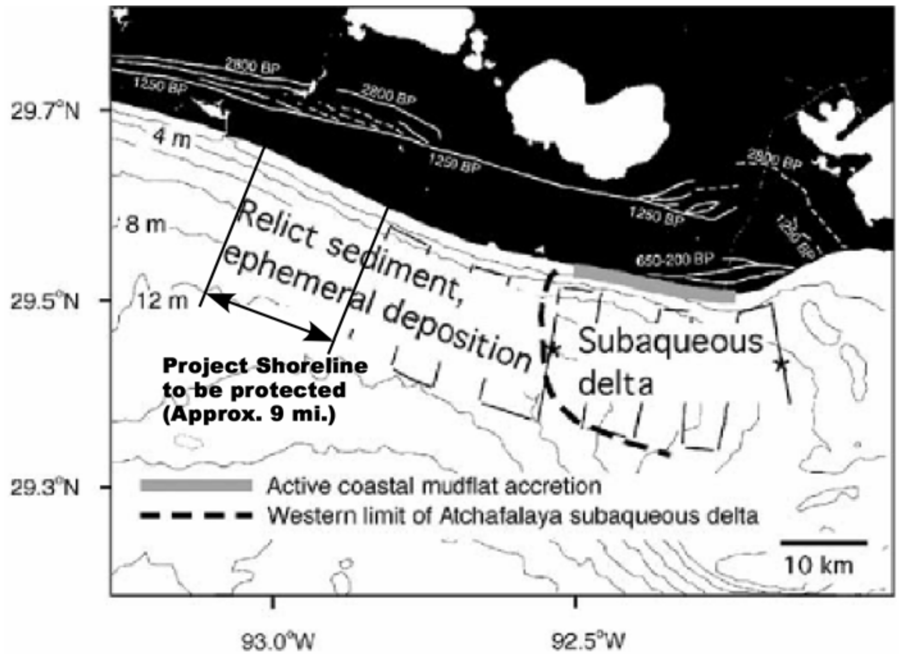

Figure 10
Western Limit of Active Coastal Accretion in Atchafalaya Delta
(Figure taken from Draut et al. 2005)

The project area is located west of the active coastal accretion (Figure 10). Shoreline retreat is the predominant geomorphological process where the Rockefeller Refuge Gulf Shoreline Stabilization Project is proposed. The lack of a sufficient sediment source is further aggravated by continuing subsidence and sea level rise.

According to the soil survey of Cameron Parish completed by the NRCS, four soil mapping units exist at Rockefeller Refuge within Cameron Parish (NRCS, 1995). The soil units are: Beaches (coastal), Clovelly muck, Creole mucky clay, and Scatlake mucky clay. These soils are characteristically very poorly drained soils, very fluid, mineral or organic soils, except for the beaches. The NRCS indicates that the Clovelly muck, Creole mucky clay, and Scatlake mucky clay soils are generally ponded with several inches of water. The major limitations of the soils are flooding, wetness, salinity, and low strength (NRCS, 1995).

According to the soil survey of Vermilion Parish completed by the NRCS, four soil mapping units exist at Rockefeller Refuge within Vermilion Parish (NRCS, 1996). The soil units are: Bancker muck, Beaches (coastal), Clovelly muck, and Scatlake mucky clay. These soils are characteristically very poorly drained soils, very fluid, mineral or organic soils, except for the beaches. The NRCS indicates that the Clovelly muck, Creole mucky clay, and Scatlake mucky clay soils are generally ponded with several inches of water most of the time. The major limitations of the soils are flooding, the wetness, the salinity, and low strength (NRCS, 1996).

The shoreface in this area is mostly composed of soft clay with a narrow zone of shell fragments above the water line. The narrow beach area is backed by extensive wetlands. The area is exposed to gulf waves, currents, and tropical storms and hurricanes. High tides and/or storms will progress well inland and produce considerable local erosion events if left unprotected.

The beach face in the project area is marked by a shell berm at approximately 4.5 ft elevation mean sea level (msl) with a relatively narrow, shallow shelf on the gulf side. A scarp exists at the seaward end of the shelf, where bottom depth quickly drops from approximately +1 to –3 ft elevation msl. From the base of the scarp, the beach slope is fairly gentle to several miles offshore. The gentle slope has a significant effect on the wave climate and limits the wave height that approaches the shore face. Most of the marsh on the landward side of the beach in the project area has an elevation of approximately 1.0 ft above msl (Wicker et al. 1983). The marshland is broken by shallow lakes and bayous and a series of abandoned beach ridges (i.e., cheniers) (Russell and Howe, 1935).

As documented in the 95% Design Report (Shiner Moseley and Associates, Inc., 2005), geotechnical investigations performed by Fugro, indicate the presence of very soft clay soils to a depth of about 40 ft in the project area. The soft soils appear to be distributed uniformly throughout the area. The presence of very soft soils that extend down relatively deep presents a unique design challenge for structural alternatives such as a nearshore breakwater or an onshore revetment. Fugro reported that the allowable bearing pressure on the soil is 250 to 330 pounds per square ft (psf), which is indicative of extremely poor foundation conditions. A rock breakwater would likely exceed this pressure by three or four times. There is very little available information on established design methodology or traditional proven approaches for shoreline stabilization projects along open coastlines that are composed of very soft clay soils similar to the project area. Even along the gulf coast of Louisiana, most prior documented projects appear to have been constructed at sites comprised of firmer soils where there is at least some sand in the beach system.

4.1.2 Climate and Weather

The climate of Southwest Louisiana is determined in part by its location in a semi-tropical latitude and its proximity to the Gulf of Mexico. It is characterized by long, hot and humid summers and short, mild and humid winters. Average daily maximum temperatures from May to October range between 83.7 and 90.7 degrees Fahrenheit (°F), and the average daily minimum temperatures for the same period range from 65.6 to 73.4°F. Average daily maximum and average daily minimum winter temperatures between November and April ranges are 60.2 to 78.2°F and 41.9 to 59.7°F, respectively (NRCS, 1995). The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night and the average at dawn is about 90 percent. The prevailing wind is from the south with the highest average wind speed of 10 miles per hour in spring.

The average annual precipitation for Cameron Parish is approximately 52 inches with about 55 percent during April through September. Thunderstorms occur on about 80 days each year. A hurricane crosses the parish every few years and a few have been extremely severe. Less rainfall usually occurs in February and March. Snow rarely occurs and is seldom on the ground for more than a day. The growing season for the project area varies between 259 and 313 days (NRCS, 1995).

4.1.3 Air Quality

Cameron and Vermillion Parishes, being rural, sparsely populated, and not within the airshed of any metropolitan areas, are not currently being, nor have they ever been, monitored by the EPA for ambient air quality. At the project area, air masses are unstable due to the proximity to the coast. There are minimal automotive air emissions from vehicles traveling Louisiana Highway 82 and the refuge roads. Boat engines, mainly two-stroke outboards on recreational fishing boats, contribute the greatest amount of air emissions. Also, there is a small amount of emission from the oil and gas production activity near the project area.

4.1.4 Surface Water Resources

The Rockefeller Refuge is located within the Chenier subbasin of the Mermentau hydrologic basin (http://www.lacoast.gov/cwppra/report/landloss/index.htm). Hydrology of the Chenier subbasin is dominated by the Lower Mermentau River and has been significantly altered through hydrologic management activities (e.g., for cattle pasture and waterfowl habitat protection). The Mermentau River-Gulf of Mexico Navigation Channel has altered the hydrology of the river by connecting the river with the gulf near Grand Chenier. This connection allows high salinity water from the Gulf of Mexico to enter the Lower Mermentau River. Drainage for marshes located in the western portion of the subbasin occurs primarily via access canals and small bayous to the Gulf. The majority of marshes between Rollover Bayou and Freshwater Bayou Canal drain eastward via access canals into the Freshwater Bayou Canal.

Cameron Parish has 354,924 acres of surface water. The Sabine, Calcasieu, and Mermentau Rivers are the largest sources of surface water. Sabine Lake, Calcasieu Lake, and Grand Lake are the largest lakes in the parish. The Mermentau River, Bayou Lacassine, Grand Lake, and part of the Intracoastal Waterway are the primary sources of fresh surface water in the parish (NRCS, 1995).

The principal use of water in Cameron Parish is for rice field irrigation. In 1980, about 57 million gallons per day were used in areas where rice is grown. Prior to Hurricane Rita in September 2005, demand was projected to increase to about 92 million gallons per day by the year 2020. More than 90 percent of the water is drawn from the Mermentau River system. The rest is drawn from ground-water sources (NRCS, 1995). At the time of writing this report, it is unknown what long term impact Hurricane Rita will have on water use.

In Vermilion Parish, the Vermilion River is the major source of surface water, flowing in a southerly direction across the eastern part of the parish. In 1982, water from the Atchafalaya River was diverted into the Teche-Vermilion system to supplement the low flows of Bayou Teche and the Vermilion River during the period of March through September. Also, flow from Bayou Teche is diverted into the Vermilion River through the Ruth Canal. At Lafayette, the average annual discharge of the Vermilion River is 723,700 acre-ft/yr (1983-86) (NRCS, 1996).

Bayou Queue de Tortue, which forms the northwestern boundary of Vermilion Parish, is another source of surface water. The bayou is a tributary to the Mermentau River, which forms the western boundary of the parish. The average flow of the Mermentau River is

1,786,000 acre-ft/yr (1985-1986). About 402 million gallons of water per day are taken from this river, and about 200 million gallons per day of this water are used within Vermilion Parish (NRCS, 1996). The parish includes several large coastal bodies of water, including Vermilion Bay, Lake Arthur, and White Lake. The Gulf of Mexico forms the southern boundary of the parish (NRCS, 1996).

4.2 Biological Environment

4.2.1 Vegetative Communities

The project area consists of 863 acres of saline marsh. The test sections would influence approximately 20 acres of saline marsh. Smooth cordgrass is the dominant plant in this marsh type, and often forms near-monotypic stands. Average salinity of a typical saline marsh is approximately 16 parts per thousand (ppt). Currently, this marsh is converting to open gulf water at a rate of 57 acres/yr within the project area. At this rate, all 863 acres of saline marsh vegetation will be lost within 20 years.

4.2.2 Fish and Wildlife

The major, initial management objective on the Rockefeller Refuge was to enhance the quality of wintering waterfowl habitat (Wicker et al. 1983). Mr. E. A. McIlhenny, often called the "Father of Louisiana Wildlife Refuges," was the moving force behind this acquisition and donation, having recognized that the area "was highly adapted for a winter feeding and resting refuge for migratory wild fowl" (McIlhenny, 1930). In addition to being "one of the most important wildlife areas in the United States", the refuge functions as a natural laboratory for research on "marsh management, plant ecology, pond culture and life history studies of the many forms of fish and wildlife found on the refuge" (Joanen, 1969).

Louisiana's coast is at the end of the Mississippi Flyway, and nearly 70 percent of the waterfowl migrating along these routes overwinter at sites in coastal Louisiana. Historically, Rockefeller Refuge wintered as many as 400,000-plus waterfowl annually, but severe drought and poor habitat quality on the breeding grounds have altered Louisiana's wintering population. More recent surveys indicate a wintering waterfowl population on Rockefeller Refuge of approximately 160,000. In addition to ducks, geese, and coots, numerous wading birds either migrate through or overwinter in Louisiana's coastal marshes. Neotropical migrant passerines also use the shrubs and trees on levees and other "upland" areas of the refuge as a rest stop on their trans-Gulf journeys to and from Central and South America (http://www.wlf.state.la.us/).

Habitat quantity is declining as described in Section 2.0, and habitat quality is changing also. Stabilizing habitat availability for wetland wildlife species requires slowing the rate at which wetlands convert to shallow open water and preventing the conversion of marsh to more saline conditions.

Coastal wetlands in Louisiana provide high quality habitat for the American alligator (*Alligator mississipiensis*), furbearers such as nutria (*Myocastor coypus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), mink (*Mustela vison*), and river otter (*Lutra canadensis*) game such as white-tailed deer (*Odocoileus virginianus*), rabbit (*Sivilagus sp.*)

squirrel (*Sciurus sp.*), and snapping turtle (*Macroclemys temmincki*) (Bellrose, 1976; McNease and Joanen, 1978; and Palmisano, 1973).

Snow goose (*Chen caerulescens*); Canada goose (*Branta canadensis*); dabbling ducks such as mallard (*Anas fulvigula*), northern pintail (*Anas acuta*), gadwall (*Anas strepera*) blue-winged teal (*Anas discors*), mottled duck (*Anas fulvigula*), green-winged teal (*Anas crecca*), and American wigeon (*Anas americana*); and diving ducks such as lesser scaup (*Aythya affinis*), greater scaup (*Aythya marila*), red-breasted merganser (*Mergus merganser*), ring-necked duck (*Aythya collaris*), redhead (*Aythya americana*), Canvasback (*Aythya valisneria*), and bufflehead (*Bucephala albeola*) are found in the Mermentau Basin.

The marsh in the project area is habitat for many estuarine dependent marine organisms. Many species immigrate from offshore into the wetlands while still in the postlarval stage. The young organisms become widely dispersed and often concentrate at the interface between marsh and waterbodies where food is abundant and shelter available. Nearing adulthood, the organisms return to more saline or Gulf waters. Action is needed to protect marsh and prevent conversion of marsh to open water.

Marine fish and shellfish such as the Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), gulf menhaden (*Brevoortia patronus*), bay anchovy (*Anchoa mitchilli*), brown shrimp, and white shrimp occur in the estuarine waters of the project area (Herke, 1978; Rogers et al. 1993). Even fish species that do not swim in flooded marshes may depend on marshes to complete part of their life cycle because detritus originating from wetland vegetation provides food for juvenile fish (Deegan et al. 1990). Menhaden, which constitute part of the largest commercial fishery in the contiguous United States, illustrate one of the many possible relationships between fish and wetlands. Menhaden spend most of their life in deep water where they are harvested, but juvenile menhaden grow and develop in estuaries where detrital marsh vegetation is an important food source (Deegan et al. 1990). Juvenile menhaden, in turn, are an important food source for carnivorous fish, turtles, and many fish-eating birds, including the pelican, the State Bird of Louisiana.

Aquatic resources of national importance found near the project site include Atlantic croaker, red drum, sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), gulf menhaden, spot, striped mullet (*Mugil cephalus*), brown shrimp, white shrimp, and blue crab (*Callinectes sapidus*) (Hoese, 1976).

Several non-federally funded species are common to the surf zone habitat in the study area. These include Florida pompano (*Trachinotus carolinus*), Atlantic threadfin (*Polydactylus octonemus*), bay anchovy, striped mullet (*Mugil cephalus*), white mullet (*Mugil curema*), Atlantic croaker, southern kingfish (*Menticirrhus americanus*), inland silverside (*Menidia beryllina*), rough silverside (*Membras martinica*), gulf menhaden, white shrimp, hardhead catfish (*Arius felis*), and blue crab (*Callinectes sapidus*) (Bellinger and Avault 1970; Tarbox 1974; Perry and Carter 1979). Of these, Florida pompano, southern kingfish, white mullet and rough silverside are often more common in the surf zone than other, more inland habitats.

Investigations into various aspects of aquaculture/fisheries, especially how fisheries relate to marsh management strategies, are conducted by the fisheries biologist at the refuge. Rockefeller staff raise and distribute striped bass from Rockefeller in an attempt to restore that species to southwest Louisiana river systems (www.wlf.state.la.us).

4.2.3 Essential Fish Habitat

The proposed project is located in areas identified as Essential Fish Habitat (EFH) for species of shrimp, red drum, and coastal migratory pelagics managed by the Gulf of Mexico Fishery Management Council (GMFMC). Specific information on categories of EFH for each species is provided in the 1998 generic amendment to the Fishery Management Plans for the Gulf of Mexico. The amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (P.L. 104-297). Essential Fish Habitat that have been designated in the project area include estuarine wetlands, water column, and mud, sand and shell substrates. These habitats in and near Rockefeller could be affected by construction and could benefit from the proposed action. Managed species, their EFH sub-category, and their period of habitat use in the project area include: brown shrimp (*Farfantepenaeus azetecus*) postlarvae and juveniles – marsh edge, tidal creeks, and inner marsh (year round); brown shrimp subadults – mud bottoms and marsh edge (year round) (Lassuy, 1983); red drum (*Sciaenops ocellatus*) postlarvae and juveniles –mud bottom, marsh edge (year round); red drum subadult/adult – mud bottom (year round) (Buckley, 1984); white shrimp (*Litopenaeus setiferus*) postlarvae, juveniles, subadults – marsh edge, submerged aquatic vegetation, marsh ponds, inner marsh and oyster reefs (year round) (Turner and Brody, 1983); and white shrimp adults (March through May); spanish mackerel (*Scomberomorous maculatus*) juveniles and subadults – Gulf from shoreline to 75 m depth; king mackerel (*Scomberomorous cavalla*) juveniles and adults – Gulf from shoreline to 200 m depth; bluefish (*Pomatomus saltatrix*) juveniles, subadults, and adults – nurseries are inshore along estuaries, beaches, and inlets; older life stages are common out to the continental shelf; cobia (*Rachycentron canadum*) post larvae, juveniles – Gulf, shore to 40 m depth; larval and juveniles – common in 3 to 9 m of water.

In addition to being designated as EFH for a number of species, aquatic and wetland habitats in the project nursery, foraging, and predator refugia habitats that support other marine fishery species discussed in the Fishery Resources section. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC.

4.2.4 Threatened and Endangered Species

Coordination with federal and state wildlife agencies was performed for the proposed project. The USFWS have concurred that the proposed action is not anticipated to have significant adverse impacts on threatened or endangered species, or candidate species.

Although the threatened piping plover (*Charadrius melodus*) and plover critical habitat (Unit LA-01) is within the project area; no adverse project impacts are anticipated. Piping plovers winter in Louisiana and may be present for 8 to 10 months. They arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sandflats, algal flats, and washover passes with no or very sparse emergent vegetation. They also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather.

The NMFS Protected Resources Division was coordinated with in the preparation of this assessment (Appendix A).

4.3 Cultural Environment

4.3.1 Historical or Archaeological Resources

Native Americans of the Attakapas Tribe lived along the cheniers and possibly along the shore of the Gulf of Mexico prior to the European colonization. Cabeza de Vaca was probably the earliest explorer of Cameron Parish and possibly some of DeSoto's people crossed the areas en route from the Mississippi River to the Spanish colonies of Mexico. In 1803, the French sold Louisiana to the United States. Anglo-Saxons and Celts settled in the southern part of the parish during the 1830's. Exiled residents of French Acadia, now Nova Scotia, settled in what is now Ascension and St. James Parishes and became the source of the "Acadians". However, it was not until the middle of the nineteenth century that they moved into the northern part of Cameron Parish (NRCS, 1995).

Fishing, farming, and trading, especially furs, were the occupations of the first settlers. Exploration for oil and gas resources first occurred during the early part of the 20th century. The construction of canals to provide access for a barge-mounted drilling rig drastically changed the landscape of coastal Louisiana. In accordance with the Deed of Donation for Rockefeller, careful mineral development has been allowed on the refuge to fund marsh development for wildlife. The Deep Lake oil and gas field and the Constance Bayou gas field are the two primary areas where oil and gas exploration has taken place.

Archeological features consist of several known shell middens on or near the refuge and a shipwreck site. The *Nuevo Constante,* a Spanish merchant ship, foundered in 19 ft of water some 1,600 ft off the coast near what is now the Rockefeller Refuge in 1766 (http://www.crt.state.la.us/archaeology/nuevo/hist). Archaeologists, under contract to the State of Louisiana, mapped and catalogued the wreck in 1981. They also searched the shore for the shipwreck survivors' camp, which had been extensively documented. They found a few historic artifacts. It appeared, however, that waves had washed it on shore. No other evidence of the survivors' camp was found. Maps show that the shoreline in this area has eroded about 4,600 ft since 1766 and it is assumed that erosion destroyed the site of the camp.

4.3.2 Economics (Employment and Income)

With so much of the area classified as wetlands, the economy of the project area is dependent upon the commercial and recreational harvest of furbearers, alligators, finfish and invertebrates. More than 40 percent of the total wild fur harvested in the United States comes from Louisiana's wetlands (Linscombe and Kinler, 1985). Although no hunting is allowed on the refuge, some regulated trapping is allowed for furbearers and alligators that could potentially damage the marsh if their populations are not controlled.

The southwestern marshes of Louisiana produce the highest nesting density for alligators; one nest to 90 acres, with the greatest density in intermediate marsh, followed by fresh and brackish marsh (McNease et al. 1994). Total coast wide marsh nest projections during 1970-1993 ranged from 6,700 to 34,500 with an increasing trend over time.

About 90 percent of the fish harvested from the Gulf of Mexico rely on aquatic habitats such as those found in the marshes of the project area. Two major fishing ports can be found to the west of the project area, one at Cameron, Louisiana and the other at Port Arthur, Texas. As much as 432 million pounds of fishery products were landed in 2000 with a value of $96.9 million (U.S. Department of Commerce, 2001).

Rockefeller technical management and research expertise is provided by six biologists. Three full-time conservation officers patrol the refuge to ensure compliance with trespass, fishing, shrimping, and other regulations. The refuge also employs a maintenance crew that repairs boats and equipment, maintains and builds levees and water control structures, roads, and various other items. Rockefeller Refuge staff are involved in a wide range of research projects. The refuge is probably best known for pioneering research in ranching, physiology, and life-history of alligator. In fact, the statewide alligator harvest and farming programs are managed and monitored primarily from Rockefeller Refuge. Statewide restoration and monitoring of brown pelican and bald eagle are also conducted from the refuge. Applied marsh management, waterfowl habitat management, and mottled duck population dynamics are other research topics ongoing at the refuge. Investigations into various aspects of aquaculture/fisheries, especially how fisheries relate to marsh management strategies, are conducted by the fisheries biologist. Refuge staff raise and distribute striped bass in an attempt to restore that species to southwest Louisiana river systems. Other research topics include alligator snapping turtle life-history, mineral development compatibility with wildlife, and other marsh wildlife studies.

4.3.3 Recreation

Recreational activities that occur on the refuge include shrimping, crabbing, fishing, bird and alligator watching. These activities account for an annual visitation rate of about 80,000 people.

4.3.4 Noise

Rockefeller Refuge has no industry other than the oil and gas fields on the eastern end of the refuge. Ambient noise in the area originates from oil and gas exploration, oil and gas production, and boats along the coast, lakes, and canals. Traffic along Louisiana Highway 82 provides the main source of noise in the vicinity of the project area.

4.3.5 Infrastructure

The project area is along the coast, with no roads in the immediate vicinity of the project area. Louisiana Highway 82 runs adjacent to the northern boundary of the refuge and is the only evacuation route for residents of the chenier plain. Several small roads provide access onto the refuge near the headquarters.

5.0 Environmental Consequences

Although the No Action alternative does not satisfy the purpose of and need for the proposed action, it is evaluated in this EA consistent with the NEPA. The No Action alternative establishes an environmental baseline for this EA. In general, the adverse environmental consequences of the no-action alternative exceed those of any other alternative.

Alternatives 2-5 have not been implemented in the conditions at the project site. Therefore, the effectiveness and subsequent evaluation, is unknown. If the structures of alternatives 2-5 fail, these alternatives could result in conditions of the No Action alternative. If the structures of alternatives 2-5 withstand the environmental conditions and maintain structural integrity, these alternatives could halt the erosion of relic sediments that comprise the base of the shoreline, and protect marshes in the project area. Due to these unknown factors, the preferred alternative (alternative 6) is a test of alternatives 2-5. Implementation of the preferred alternative would provide a comparison of alternatives 2-5, and provide information that would assist in determining appropriate courses of future action.

If the preferred alternative is implemented and a full-length alternative subsequently considered, an addendum to this EA would be published to comply with the NEPA. The addendum would provide the environmental consequences resulting from the test sections (preferred alternative).

5.1 Physical Environment

5.1.1 Geology, Soils, and Topography

ALTERNATIVE 1: NO ACTION
To take no action would allow current shoreline erosion rates to continue.

ALTERNATIVE 2: BEACH FILL WITH GRAVEL/CRUSHED STONE
This alternative has been used successfully in providing shoreline protection in other projects (Shiner Moseley and Associates, Inc. 2005). With the soft clays of the project area, however, this alternative may not provide solid protection from incoming offshore waves. Impacts would consist of placing gravel/crushed rock on the soft clay beach. If successful in providing shoreline protection from incoming waves, the impacts from beach fill would be minimal in comparison with the benefits of protecting shoreline and marsh soils from erosion. If unsuccessful in providing shoreline protection, the gravel/crushed stone would allow current shoreline erosion rates to continue.

ALTERNATIVE 3: REEF BREAKWATER WITH GRAVEL /CRUSHED STONE BEACH FILL
The majority of the impacts would consist of disturbing the recently deposited, under consolidated marine clays during the construction process. Impacts would also be similar to Alternative 2.

ALTERNATIVE 4: REEF BREAKWATER WITH LIGHTWEIGHT AGGREGATE CORE
Impacts would be the similar to Alternative 3.

ALTERNATIVE 5: CONCRETE PANEL BREAKWATER
Impacts would be the similar to Alternative 3.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
It is likely that the test sections of some of the above alternatives are successful at decreasing shoreline erosion. Soils would likely be positively altered by the halting of shoreline erosion, and the degradation of the shell fragment covered beaches, thereby protecting the fragile wetland soil system of the Chenier plain. Structures that fail to protect the shoreline would be removed at the completion of the test observation time, approximately 1 year after construction. The gravel/crushed stone beach fill would not be removed, and would not adversely impact the project area. Under category one or greater storms, breakwater alternatives would allow a percentage of the significant wave height to transmit landward of the structures, flooding the marsh with as much as three feet of water. Under these conditions, it is expected that erosion would occur, but to a lesser extent than without the breakwater.

5.1.2 Climate and Weather

No impacts to climate and weather would result from any of the alternatives.

5.1.3 Air Quality

ALTERNATIVE 1: NO ACTION
No impacts to air quality would result from the no-action alternative.

ALTERNATIVE 2-5:
Minor temporary adverse impacts would result from the proposed activities. Exhaust emissions from dredging equipment with airborne pollutants would be quickly dissipated by prevailing winds and be limited to the construction phase of the project. The construction phase is likely to be more than 500 days, based on the estimated time provided for the preferred alternative. The remaining benefits of the project would be for a minimum of 20-years.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
Minor temporary adverse impacts would result from the proposed activities. Exhaust emissions from dredging equipment with airborne pollutants would be quickly dissipated by prevailing winds and be limited to the construction and removal phases. Construction would be limited to 200 days and removal phase would be less than 200 days (Shiner Moseley and Associates, Inc. 2005).

5.1.4 Surface Water Resources

ALTERNATIVE 1: NO ACTION
No impacts to air quality would result from the no-action alternative.

ALTERNATIVE 2: BEACH FILL WITH GRAVEL/CRUSHED STONE
Dredging would increase turbidity during the construction phase along the 9.2 mile area. After construction, turbidity would be expected to return to pre-construction conditions.

ALTERNATIVE 3-5:
Dredging would increase turbidity during the construction phase along the 9.2 mile area. After construction, turbidity would be decreased between the structures and shoreline for a greater length of time than the construction time.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
Dredging in the 0.56 mile long area would increase turbidity during construction and removal phases.

5.2 Biological Environment

5.2.1 Vegetative Communities

ALTERNATIVE 1: NO ACTION
To take no action would allow current shoreline erosion rates to continue. The result would be continued loss of marsh at current rates of approximately 50 ft/yr (57 acres/yr) (Shiner Moseley and Associates, Inc. 2005).

ALTERNATIVE 2-3:
Placement of beach fill would adversely affect some existing vegetation over the 9.2 miles of shoreline. The vegetation affected would be lost with no action. The alternative has the potential to protect acres of vegetation north of the shoreline.

ALTERNATIVE 4-5:
This alternative would not impact vegetation on the shoreline, and has the potential to protect acres of vegetation north of the 9.2 mile shoreline. If this alternative does not withstand storm conditions, minor adverse impacts could occur due to sections of the Reef Breakwater being deposited on vegetation along the shoreline or marsh. These adverse impacts would be less than losses expected with no action.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
Placement of beach fill would adversely affect some existing vegetation along 1200 ft of shoreline. The vegetation affected would be lost with no action, and more vegetation would be affected by alternatives 2 or 3. The alternative has the potential to protect vegetation north of the shoreline, and determine which above alternative would best protect acres of vegetation.

5.2.2 Fish and Wildlife

ALTERNATIVE 1: NO ACTION
The no action alternative would allow continued conversion of marsh to open water. This would allow the continued loss of marsh that supports 70% of the estuarine species. This would decrease the ability of the project area to support fisheries species, and decrease fisheries diversity in the project area.

ALTERNATIVE 2-3: The alternative has the potential to protect acres of habitat necessary for a majority of fisheries species. The alternative would increase the diversity of fisheries by adding diversity to the habitat with gravel/crushed stone. Minor adverse impacts due to burial of non-mobile benthic organisms would result from placement of gravel/crushed stone on the shoreline.

ALTERNATIVE 4-5: The alternative has the potential to protect acres of habitat necessary for a majority of fisheries species. Minor adverse impacts due to burial of non-mobile benthic organisms would result from placement of gravel/crushed stone on the shoreline, and construction of reef walls. The alternative would increase the diversity of fisheries habitat by adding structure to the water column. The alternative is designed to allow ingress and egress by the incorporation of fish gaps.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
The proposed alternative has the potential to protect some desirable EFH (marsh) from conversion to less desirable EFH (open water, mud). The alternative would increase the diversity of EFH in the immediate area by adding rock bottom and would not adversely impact fisheries access. Minor adverse impacts due to burial of non-mobile benthic organisms would result from dredging, placement of gravel/crushed stone on the shoreline, and construction of reef walls. There would be no long-term impacts, because the components would be removed after a period of approximately one year.

5.2.3 Essential Fish Habitat

ALTERNATIVE 1: NO ACTION
The no action alternative would allow continued conversion of marsh to open water. This would allow the continued conversion of higher quality EFH to a lesser quality EFH, and decrease the ability of the project area to support marsh dependent species (brown shrimp, white shrimp and red drum). The alternative would have little effect on other categories of EFH such as water column and mud, sand and shell substrates.

ALTERNATIVE 2-3: The alternative has the potential to protect acres of marsh EFH from conversion to water, mud EFH by stabilizing shoreline. The alternative would increase the diversity of EFH in the immediate area by adding gravel/crushed stone bottom to the otherwise mud dominated bottom. Protection of marsh would maintain the area's ability to support the managed species and prey of managed species that depend upon the marsh. Some adverse impacts to mud bottom and water column would result from dredging. The dredging and filling for the construction of the flotation channels would result in minor and temporary turbidity increases in the vicinity of the project area which may cause managed species to avoid the area during construction and structural removing activities, and for a short time afterward.

ALTERNATIVE 4-5: The alternative has the potential to protect acres of marsh EFH from conversion to open water, mud EFH. The alternative is designed to allow ingress and egress by the incorporation of fish gaps. Protection of marsh would maintain the area's ability to support the managed species and prey of managed species that depend upon the marsh. Some adverse impacts to mud bottom and water column would result from dredging. The dredging and filling for the construction of the flotation channels would result in minor and temporary turbidity increases in the vicinity of the project area which may cause managed species to avoid the area during construction and structural removing activities, and for a short time afterward.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
The proposed alternative has the potential to protect some marsh EFH from conversion to open water, mud EFH. The alternative would temporarily increase the diversity of EFH in the immediate area by adding gravel/crushed stone bottom. There would be no long-term impacts, because the structural components would be removed after a period of approximately one year. Protection of marsh would maintain the area's ability to support the managed species and prey of managed species that depend upon the marsh. Some adverse impacts to mud bottom and water column would result from dredging. The dredging and filling for the construction of the flotation channels would result in minor and temporary turbidity increases in the vicinity of the project area which may cause managed species to avoid the area during construction and structural removing activities, and for a short time afterward.

5.2.4 Threatened and Endangered Species

No alternative is likely to adversely affect listed threatened and endangered species or their critical habitat.

5.3 Cultural Environment

5.3.1 Historical or Archeological Resources

No impacts are anticipated to historical or archaeological resources within the project area from any of the alternatives.

5.3.2 Economics (Employment and Income)

No impacts are anticipated to economics with any alternative.

5.3.3 Recreation

ALTERNATIVE 1: NO ACTION
The no action alternative would decrease the ability of the area to support recreational fishing and birding, and decrease the size of a state wildlife preserve.

ALTERNATIVE 2-5: The alternative would not adversely impact land use and may maintain the ability of the area to support recreational fishing and birding by preserving several acres of a state wildlife preserve.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
The proposed alternative has the potential to protect some of a state wildlife preserve, and to provide information that would indicate what additional action would maintain the current recreation use that is expected to be lost with the no action alternative.

5.3.4 Noise

ALTERNATIVE 1: NO ACTION
No noise would occur as a result of the no action alternative.

ALTERNATIVE 2-6:
Some minimal adverse short-term impacts to noise would occur as a result of construction activities. The project is on state property in a remote area and, therefore, construction activities are unlikely to be a disturbance.

5.3.5 Infrastructure

ALTERNATIVE 1: NO ACTION
With no action the threat of storm events damaging infrastructure on the chenier ridges increases as less marsh is available to lessen impacts by providing a buffer. The primary infrastructure, Louisiana Highway 82, is the only evacuation route for residents in the Chenier plain.

ALTERNATIVE 2-5:
The alternative may decrease the threat of storm events damaging infrastructure, by protecting the marsh that buffers the infrastructure. No adverse impacts to infrastructure would result from the alternative.

ALTERNATIVE 6 (PREFERRED): TEST SECTIONS
The preferred alternative would not impact infrastructure. The alternative would determine what alternative above could best protect infrastructure.

6.0 Environmental Justice

Executive Order 12898 (Environmental Justice) requires "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…". The proposed Rockefeller Refuge Gulf Shoreline Stabilization Project has been reviewed for compliance with this order and it has been determined that the preferred alternative would not adversely affect the health or environment of minority or low-income residents.

7.0 Cumulative Impacts

Cumulative impacts are those changes to the physical, biological, and socioeconomic environments that would result from the combination of construction, operation and associated impacts resulting from the proposed action when added to other past, present, and reasonably foreseeable actions. Past projects, or those implemented or built before 2002, can be considered to be part of the existing conditions environment baseline presented in this EA. Included within the concept of past projects are all maintenance activities, land development projects, and other actions that occurred before detailed analysis began on this EA. In this regard, the cumulative impact of the proposed project can be viewed as positive. The project, in conjunction with other coastal restoration projects constructed or planned, is intended to improve the physical, biological, and socioeconomic environments in the area. It is foreseeable that the proposed action would lead to future environmental benefits, such as the implementation of one of the other alternatives considered in this EA.

8.0 Conclusions

This report describes the environmental assessment of the Rockefeller Refuge Gulf Shoreline Stabilization Project, which is a CWPPRA wetland restoration project. The goals of this project are to (1) halt Gulf shoreline retreat and direct marsh loss from Beach Prong to Joseph Harbor over the 20-year life of the project, (2) protect saline marsh habitat, and (3) enhance fish and wildlife habitat.

Because of the unique conditions along the Refuge, the innovative nature of the proposed alternatives, and the lack of definitive design methodology, test sections are proposed for further evaluation. Prototypes of four alternatives (Beach fill with gravel/crushed stone; Reef breakwater with gravel/crushed stone beach fill; Reef breakwater with lightweight aggregate core; and, Concrete panel breakwater, respectively) will be tested in the project area to identify the alternative, if any, to be implemented for the entire 9.2 mile project area. The test installations will allow detailed evaluation and comparison of each of the four alternatives in terms of constructability, ability to deal with the soft soils, wave attenuation, shoreline response, cost, maintenance requirements, and aesthetics. Pending funding, test installations of the four alternatives will be constructed and subjected to field tests for a duration of one year and removed upon completion of observations.

This EA concluded that there are no significant adverse environmental impacts anticipated by the implementation of the project. This conclusion is based on a comprehensive review of relevant literature, site specific data, and project-specific engineering reports. This finding supports the recommendations of the CWPPRA Task Force, including the NOAA Fisheries Service, the sponsoring agency. The natural resource benefits anticipated from the implementation of Rockefeller Refuge Gulf Shoreline Stabilization Project are expected to sustain the Chenier plain ecosystem within the project area.

9.0 Preparers

This EA was prepared by Ms. Joy Merino of the National Marine Fisheries Service. Invaluable reference material and guidance were provided by Dr. John D. Foret and Dr. Erik Zobrist of the National Marine Fisheries Service.

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APPENDIX A

Agency Coordination Letters

(Agency Coordination Letters to be inserted HERE)