DEEPWATER HORIZON OIL SPILL

LOUISIANA TRUSTEE IMPLEMENTATION GROUP DRAFT RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT #6: RESTORE AND CONSERVE WETLANDS, COASTAL, AND NEARSHORE HABITAT

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Cover photographs courtesy of USDA Agricultural Research Service and the Deepwater Horizon NRDA Trustee Council.

EXECUTIVE SUMMARY

On April 20, 2010, the Deepwater Horizon (DWH) mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico, resulting in a massive release of oil and other substances from BP Exploration and Production's (BP) Macondo well and causing loss of life and extensive natural resources injuries. Initial efforts to cap the well following the explosion were unsuccessful, and for 87 days after the explosion, the well continuously and uncontrollably discharged oil and natural gas into the northern Gulf of Mexico. Approximately 3.19 million barrels (134 million gallons) of oil was released into the ocean (U.S. District Court for the Eastern District of Louisiana 2016). Oil spread from the deep ocean to the ocean surface and nearshore environment from Texas to Florida. The oil came in contact with, and injured, diverse natural resources such as deep-sea coral, fish and shellfish, productive wetland habitats, sandy beaches, birds, endangered sea turtles, and protected marine life. The oil spill prevented people from fishing, going to the beach, and enjoying typical recreational activities along the Gulf of Mexico. Extensive response actions, including cleanup activities and actions to try to prevent the oil from reaching sensitive resources, were undertaken to try to reduce harm to people and the environment. However, many of the response actions had collateral impacts on the environment and on natural resource services. The oil and other substances released from the well in combination with the extensive response actions together make up the DWH Oil Spill.

As an oil pollution incident, the DWH Oil Spill is subject to the provisions of the Oil Pollution Act (OPA) of 1990, 33 United States Code 2701 et seq., which makes parties responsible for an oil spill liable for the costs of responding to and cleaning up the oil spill, as well as the costs of assessment and restoration needed to compensate for injuries to natural resources and the services they provide. OPA specifies that trustees responsible for representing the public's interest (in this case, state and federal agencies) must be designated to act on behalf of the public to assess the injuries and to address those injuries.

As required under OPA, the DWH Oil Spill Trustees (DWH Trustees) conducted a natural resource damage assessment (NRDA) and prepared the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS) (DWH Trustees 2016). The DWH Trustees conducted a NRDA to

- assess the impacts of the DWH Oil Spill on natural resources in the Gulf of Mexico and the services those resources provide, and
- determine the type and amount of restoration needed to compensate the public for these impacts.

Following the NRDA, the DWH Trustees determined that the injuries caused by the DWH Oil Spill could not be fully described at the level of a single species, a single habitat type, or a single region. Rather, the injuries affected such a wide array of linked resources over such an enormous area that the effects of the DWH Oil Spill must be described as constituting an ecosystem-level injury. Consequently, the DWH Trustees proposed a comprehensive, integrated ecosystem restoration plan with a portfolio of restoration types that addresses the diverse suite of injuries that occurred at both regional and local scales, based on the following five overarching goals:

1. Restore and conserve habitat
2. Restore water quality
3. Replenish and protect living coastal and marine resources
4. Provide and enhance recreational opportunities
5. Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation

These five goals work both independently and together to benefit injured resources and services through the following restoration goals (DWH Trustees 2016: Sections 5.5.2 through 5.5.14):

- The goal of restoring a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.
- The goal of restoring for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- The goal of acknowledging the existing distribution of habitats throughout the Gulf of Mexico; restoring habitats in appropriate combinations for any given geographic area while considering design factors, such as connectivity, size, and distance between projects; addressing injuries to the associated living coastal and marine resources; and restoring the ecological functions provided by those habitats.

LA TIG Restoration Plan and Environmental Assessment #6

This document, hereinafter referred to as the *Louisiana Trustee Implementation Group Draft Restoration Plan/Environmental Assessment #6: Restore and Conserve Wetlands*, *Coastal and Nearshore Habitat* and abbreviated as RP/EA, was prepared by the Louisiana Trustee Implementation Group (LA TIG) pursuant to OPA and is consistent with the DWH Trustees' findings in the Final PDARP/PEIS. The LA TIG comprises five Louisiana state trustee agencies and four federal trustee agencies:

- Louisiana Coastal Protection and Restoration Authority (CPRA)
- Louisiana Department of Natural Resources (LDNR)
- Louisiana Department of Environmental Quality (LDEQ)
- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana Oil Spill Coordinator's Office (LOSCO)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Department of the Interior (DOI)
- U.S. Department of Agriculture (USDA)
- U.S. Environmental Protection Agency (EPA)

In accordance with 40 Code of Federal Regulations (CFR) 1508.12, the LA TIG designated EPA as the lead federal agency responsible for National Environmental Policy Act (NEPA) compliance for this RP/EA. The federal and state agencies of the LA TIG are acting as cooperating agencies for the purposes of compliance with NEPA in the development of this RP/EA. Each federal cooperating agency on the LA TIG intends to adopt, if appropriate, the NEPA analyses in this RP/EA. In accordance with 40 CFR 1506.3(a), each of the three federal cooperating agencies (DOI, NOAA, and USDA) participating on the LA TIG will review this RP/EA for adequacy in meeting the standards set forth in each agency's specific NEPA implementing procedures and decide whether to adopt the analysis in this RP/EA. Adoption of this RP/EA would be completed via signature on the relevant NEPA decision document.

The LA TIG has an allocation of $5 billion for restoration activities in the Louisiana Restoration Area, which includes Early Restoration projects approved prior to the settlement with BP in 2016. Because of the significant injury to the Gulf of Mexico ecosystem, where habitats are closely linked, as a result of the DWH Oil Spill, approximately $4 billion of these funds are dedicated to the Wetlands, Coastal, and Nearshore Habitats restoration type.

The focus of this RP/EA is implementation of the Final PDARP/PEIS restoration type, Restore and Conserve Wetlands, Coastal, and Nearshore Habitat. This restoration type is intended to restore wetlands, coastal, and nearshore habitats, which integrate and form a continuum within the nearshore ecosystem and contribute to an integrated, connected food web (Baillie et al. 2015; Boesch and Turner 1984; Boström et al. 2011; Deegan 1993; Deegan et al. 2000; Nelson et al. 2011; Nelson et al. 2013, as cited in DWH Trustees 2016) across the Gulf and address multiple ecosystem benefits through habitat restoration. Identifying opportunities to restore multiple habitats within one project, or to implement multiple projects within a given area, may accelerate recovery of injured ecosystem functions and achieve a more integrated restoration of the nearshore ecosystem and its service flows.

In developing this RP/EA's reasonable range of alternatives, the LA TIG considered the following:

- OPA screening criteria
- Specific goals identified in the Final PDARP/PEIS under the Restore and Conserve Wetlands, Coastal, and Nearshore Habitat restoration type
- Other criteria identified by the DWH Trustees
- Input from the public
- The current and future availability of funds under the DWH Oil Spill NRDA settlement payment schedule

In total, the LA TIG identified four projects in the range of reasonable alternatives in addition to the No Action Alternative. These projects (hereinafter alternatives) are intended to restore or replace habitats, species, and services in the Louisiana Restoration Area to their baseline condition (primary restoration) and to compensate the public for interim losses from the time natural resources are injured until they recover to baseline conditions (compensatory restoration).

Restore and conserve habitat alternatives considered in this RP/EA would help create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beaches that were negatively impacted as a result of the DWH Oil Spill. After evaluating all four alternatives included in the reasonable range of alternatives, the LA TIG is proposing three of these alternatives as preferred alternatives for implementation. Table ES-1 identifies the alternatives evaluated in this RP/EA and which of those alternatives are proposed as preferred alternatives for implementation.

Table ES-1. Restore and Conserve Habitat Alternatives

Alternative	Location (Parish)	Preferred Alternative
West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	Yes
Golden Triangle Marsh Creation	Orleans and St. Bernard	Yes
Biloxi Marsh Living Shoreline	St. Bernard	Yes
Fifi Island Forested Ridge with Breakwater	Jefferson	No

The LA TIG has evaluated the environmental consequences of the alternatives comprising a reasonable range of alternatives consistent with NEPA, and the preliminary findings indicate that no significant environmental impacts are anticipated. The LA TIG has prepared this RP/EA to inform the public about DWH NRDA restoration planning efforts and to seek public comment on the identified reasonable range of alternatives and the preliminary finding of no significant impact.

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Abbreviations

ACM	asbestos containing materials
APE	area of potential effect
AQS	air quality station
AST	aboveground storage tanks
BFE	base flood elevation
BGEPA	Bald and Golden Eagle Protection Act of 1940
BMPs	best management practices
BP	BP Exploration and Production, Inc.
BWW	Barataria Bay Waterway
CBRS	Coastal Barrier Resources System
CEC	Coastal Engineering Consultants, Inc.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPRA	Coastal Protection and Restoration Authority
CRMS	Coastwide Reference Monitoring System
CUP	Coastal Use Permit
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DOI	U.S. Department of the Interior
DWH	Deepwater Horizon
DWH Trustees	DWH Oil Spill Trustees
E&D	engineering and design
EFH	essential fish habitat
EFHA	Essential Fish Habitat Areas Protected from Fishing
EMU	Environmental Management Unit
EO	executive order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FEMA	Federal Emergency Management Agency
FONSI	finding of no significant impact
FWP	Fish and Wildlife Propagation
GEBF	Gulf Environmental Benefit Fund
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fishery Management Council

h	horizontal
HAPC	Habitat Areas of Particular Concern
HET	Hydro-Environmental Technology
HTRW	hazardous, toxic, and radioactive waste
IHNC	Inner Harbor Navigation Canal
LA TIG	Louisiana Trustee Implementation Group
LAC	Louisiana Administrative Code
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LMRE	Lower Mississippi River Ecosystem
LOSCO	Louisiana Oil Spill Coordinator's Office
MAM	monitoring and adaptive management
MBTA	Migratory Bird Treaty Act of 1908
MCA	marsh creation areas
MCY	million cubic yards
MMPA	Marine Mammal Protection Act of 1972
MRGO	Mississippi River Gulf Outlet
NAAQS	National Ambient Air Quality Standard
NAVAIDS	Navigation Aids
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Foundation
NM	nautical miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	notice of solicitation
NRDA	natural resource damage assessment
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OYS	Oyster Propagation
PCR	Primary Contact Recreation
PDARP	Programmatic Damage Assessment and Restoration Plan
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter

REC	recognized environmental conditions
RECAP	Risk Evaluation/Corrective Action Program
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012
RESTORE Council	Gulf Coast Ecosystem Restoration Council
ROD	record of decision
RP/EA	restoration plan/environmental assessment
RS	Louisiana Revised Statute
SAV	submerged aquatic vegetation
SCR	Secondary Contact Recreation
SFHA	Special Flood Hazard Areas
SHPO	State Historic Preservation Office
SOP	standard operating procedure
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
v	vertical
WCA	water column associated
WMA	Wildlife Management Area

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1 INTRODUCTION

The Louisiana Trustee Implementation Group (LA TIG) prepared this restoration plan/environmental assessment, *Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat* (RP/EA), to evaluate projects to create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beaches that were injured as a result of the Deepwater Horizon (DWH) Oil Spill. This RP/EA was prepared by the federal and state natural resource trustees for the LA TIG, which is responsible for restoring the natural resources and services within the Louisiana Restoration Area that were injured by the April 20, 2010, DWH Oil Spill. The Louisiana Restoration Area comprises the entire state of Louisiana.

The LA TIG comprises five Louisiana state trustee agencies and four federal trustee agencies: the Louisiana Coastal Protection and Restoration Authority (CPRA), Louisiana Department of Environmental Quality (LDEQ), Louisiana Department of Natural Resources (LDNR), Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Oil Spill Coordinator's Office (LOSCO), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of the Interior (DOI), U.S. Department of Agriculture (USDA), and U.S. Environmental Protection Agency (EPA).

The LA TIG has prepared this RP/EA to inform the public about the DWH natural resource damage assessment (NRDA) restoration planning efforts and to seek public comment on the identified reasonable range of alternatives for completion of engineering and design (E&D) (which for alternatives considered in this RP/EA are well underway) and construction (henceforth "implementation") (see Section 1.10 for details).

Project-specific restoration activities are discussed in this RP/EA and on a broader, programmatic basis in the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS) (DWH Oil Spill Trustees [DWH Trustees] 2016)[1], which analyzes many types of restoration activities that could be implemented with DWH NRDA funding. The purpose of restoration is to make the environment and the public whole for injuries resulting from the incident by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses in accordance with the Oil Pollution Act of 1990 (OPA) and associated NRDA regulations. The Final PDARP/PEIS and record of decision (ROD) can be found online at http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan (DWH Trustees 2016).

1.1 Background and Summary of the Settlement

On April 20, 2010, the DWH mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico, resulting in a massive release of oil and other substances from BP Exploration and Production, Inc.'s (BP's) Macondo well and causing loss of life and extensive natural resource injuries. The oil spill also prevented people from enjoying typical recreational activities, such as fishing and spending time on the beach, along the Gulf of Mexico. Extensive response actions, including cleanup activities and actions to try to prevent the oil from reaching sensitive resources, were undertaken to try to reduce harm to people and the environment. However, many of these response actions had collateral impacts on the environment and natural resource services. The oil and other substances released from the well, in combination with the extensive response actions, together make up the impacts of the DWH Oil Spill.

[1] The Final PDARP/PEIS— *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*—is referred to frequently throughout the RP/EA, and therefore the author-date citation is provided here at first mention only.

The DWH Oil Spill occurred within a northern Gulf of Mexico ecosystem where ecological resources and habitats are closely linked. Energy, nutrients, and organisms move between habitats in this region, such that injuries to one habitat or species can have cascading impacts across the entire ecosystem (see Section 3 of the Final PDARP/PEIS). As part of the injury assessment for the DWH Oil Spill, the DWH Trustees documented injuries to species including shrimp, fish, shellfish, birds, and marine mammals. These injuries ranged from decreased growth rates to reproductive effects and mortality. Many of these injured species depend on the nearshore marsh and estuarine habitats exemplified by those in Louisiana's Barataria Basin for one or more of their life stages.

On February 19, 2016, the DWH Trustees issued the Final PDARP/PEIS detailing a specific proposed plan to fund and implement restoration projects across the Gulf of Mexico region into the future as restoration funds become available. The Final PDARP/PEIS describes restoration types, approaches, and techniques that meet the Trustees' programmatic restoration goals. On March 29, 2016, in accordance with OPA and the National Environmental Policy Act (NEPA), the DWH Trustees issued a notice of availability of a ROD for the Final PDARP/PEIS in the *Federal Register* (NOAA Fisheries 2016). Based on the DWH Trustees' injury determination established in the Final PDARP/PEIS, the ROD sets forth the basis for the DWH Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative. As described in the PDARP/PEIS, "Alternative A is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem" (DWH Trustees 2016: 5–17). The DWH Trustees' selection of Alternative A includes the funding allocations established in the Final PDARP/PEIS.

On April 4, 2016, the United States District Court for the Eastern District of Louisiana entered a Consent Decree resolving civil claims by the DWH Trustees against BP arising from the DWH Oil Spill. This historic settlement resolves the DWH Trustees' claims against BP for natural resources damages under OPA. Under the Consent Decree, BP agreed to pay, over a 15-year period, a total of $8.1 billion in natural resource damages (which includes BP's previously commitment to pay up to $1 billion for Early Restoration projects) and up to an additional $700 million (some of which is in the form of accrued interest) for adaptive management or to address injuries to natural resources that are presently unknown but may come to light in the future. Each restoration area has a specific monetary allocation to each of the 13 restoration types specified in the Consent Decree. The DWH settlement allocation for the LA TIG by restoration type is described in Section 5.10.2 of the Final PDARP/PEIS. Funds allocated to the Louisiana Restoration Area for the Wetlands, Coastal, and Nearshore Habitats restoration type are $4,009,062,700 (DWH Trustees 2019). These allocations do not include funds allocated for Early Restoration projects. More details on the background of the DWH Oil Spill, the impact of the spill on the Gulf of Mexico ecosystem, and additional context for the settlement and allocation of funds can be found in Chapter 2 of the Final PDARP/PEIS.

1.2 Deepwater Horizon Trustees, Trustee Council, and Trustee Implementation Group

The DWH Trustees are the entities authorized under OPA to act as trustees on behalf of the public to assess the natural resource injuries resulting from the DWH Oil Spill and to develop and implement project-specific restoration plans to compensate for those injuries. DWH Trustees fulfill these responsibilities by developing restoration plans, providing the public with a meaningful opportunity to submit restoration projects and to review and comment on proposed plans, implementing and monitoring restoration projects and activities, managing natural resource damage funds, and documenting trustee decisions through a public administrative record. The DWH Trustees are responsible for governance of restoration planning throughout the entire Gulf Coast.

As required under OPA, the DWH Trustees conducted a NRDA. To work collaboratively on the NRDA, the DWH Trustees organized a Trustee Council composed of Designated Natural Resource Trustee Officials, or their alternates, for each of the DWH Trustee agencies. The following federal and state agencies are the designated DWH Trustees under OPA for the DWH Oil Spill:

- NOAA, on behalf of the U.S. Department of Commerce
- DOI, as represented by the National Park Service, U.S. Fish and Wildlife Service (USFWS), and Bureau of Land Management
- EPA
- USDA
- The State of Alabama's Department of Conservation and Natural Resources and Geological Survey of Alabama
- The State of Florida's Department of Environmental Protection and Fish and Wildlife Conservation Commission
- The State of Louisiana's CPRA, LOSCO, LDEQ, LDWF, and LDNR
- The State of Mississippi's Department of Environmental Quality
- The State of Texas' Parks and Wildlife Department, General Land Office, and Commission on Environmental Quality

The DWH NRDA funds provided under the Consent Decree were distributed geographically to address the diverse suite of injuries that occurred at both regional and local scales. As specified in the Consent Decree and Final PDARP/PEIS, specific amounts of money were allocated to seven geographic areas: each of the five Gulf States (Texas, Louisiana, Mississippi, Alabama, and Florida), regionwide, and the open ocean. The funding distribution was based on the DWH Trustees' understanding and evaluation of exposure and injury to natural resources and services, as well as their evaluation of where restoration spending for the various restoration types would be most beneficial within the ecosystem-level restoration portfolio.

1.3 Authorities and Regulations

1.3.1 Oil Pollution Act Compliance

As an oil pollution incident, the DWH Oil Spill is subject to the provisions of OPA (33 United States Code [USC] 2701 et seq.). A primary goal of OPA is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving an oil discharge or substantial threat of an oil discharge. Under OPA, each party responsible for a vessel or facility from which oil is discharged, or which poses the substantial threat of a discharge, may be liable for, among other things, removal costs and damages for injury to, destruction of, loss, or loss of use of natural resources, including the reasonable cost of assessing the damage.

This process of injury assessment and restoration planning is referred to as NRDA. NRDA is described under Section 1006 of OPA (33 USC 2706 et seq.). Under OPA NRDA regulations (15 Code of Federal Regulations [CFR] 990 et seq.), the NRDA process consists of three phases: 1) pre-assessment, 2) restoration planning, and 3) restoration implementation. The DWH Trustees are currently in the restoration planning and the restoration implementation phases of the NRDA. As part of the initiation of restoration implementation, this RP/EA identifies a reasonable range of alternatives; evaluates those alternatives under various criteria; and identifies a suite of preferred alternatives that would compensate the public for injuries to wetlands, coastal, and nearshore habitats in Louisiana caused by the DWH Oil Spill.

1.3.2 National Environmental Policy Act Compliance

Under OPA regulations, federal trustees must comply with NEPA, 42 USC 4321 et seq. and its regulations, 40 CFR 1500 et seq., and other applicable statutes and regulations when planning restoration projects. NEPA requires federal agencies to consider the potential environmental impacts of their proposed actions. NEPA provides a framework for federal agencies to determine if their proposed actions may have significant environmental effects and related social and economic effects, to consider these effects when choosing between alternatives, and to inform and involve the public in the environmental analysis and decision-making process.

NEPA and its implementing regulations (40 CFR 1500–1508, together and with agency-specific NEPA regulations) outline the responsibilities of federal agencies in the NEPA process. In this RP/EA, the LA TIG addresses these requirements by using the environmental analyses conducted in the Final PDARP/PEIS, evaluating and refining existing analyses, and preparing environmental consequences analyses for projects (or alternatives considered in this RP/EA), as appropriate. See Chapter 6 of the Final PDARP/PEIS for more information on tiering, and incorporation by reference under NEPA, and how these processes apply to this RP/EA.

Consistent with 40 CFR 1508.16, the LA TIG designated EPA as the lead federal agency responsible for NEPA compliance for this RP/EA. The federal and state agencies of the LA TIG are acting as cooperating agencies for the purposes of NEPA in the development of this RP/EA. Each federal cooperating agency on the LA TIG intends to comply with NEPA by adopting, if appropriate, the analysis in this RP/EA. In accordance with 40 CFR 1506.3(a), each of the three federal cooperating agencies (DOI, NOAA, and USDA) participating in the LA TIG will review this RP/EA for adequacy in meeting the standards set forth in each agency's own NEPA implementing procedures. If deemed appropriate, adoption of the EA will be completed via signatures on the relevant NEPA decision document. There are no other cooperating federal, state, or local entities, or tribes.

This RP/EA includes a preliminary finding of no significant impact (FONSI) in Section 6.3.1. EPA's NEPA implementing procedures at 40 CFR 6.203(b)(1) state that "[a]t least thirty (30) calendar days before making the decision on whether, and if so how, to proceed with a proposed action, the Responsible Official must make the EA and preliminary FONSI available for review and comment to the interested federal agencies, state and local governments, federally-recognized Indian tribes and the affected public. The Responsible Official must respond to any substantive comments received and finalize the EA and FONSI before making a decision on the proposed action." The required thirty-day public comment period commences upon publication of this RP/EA in the *Federal Register* and the *Louisiana Register*.

More information about OPA and NEPA, as well as their application to DWH Oil Spill restoration planning, can be found in Chapters 5 and 6 of the Final PDARP/PEIS.

1.3.3 Standard Operating Procedures Compliance

Another document that guides restoration planning is the *Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill* (Trustee Council 2016). The Trustee Council developed the standard operating procedures (SOPs) for administration, implementation, and long-term management of restoration under the Final PDARP/PEIS. It should be noted that SOPs are currently being revised. The Trustee Council SOP documents the overall structure, roles, and decision-making responsibilities of the Trustee Council and provides the common procedures to be used by all TIGs. The Trustee Council SOP addresses, among other issues, the following topics: decision-making and delegation of authority, funding, administrative procedures, project reporting, monitoring and adaptive management (MAM), consultation opportunities among the DWH Trustees, public participation, and the administrative record.

The Trustee Council SOP is available online through the NOAA Restoration Portal at http://www.gulfspillrestoration.noaa.gov/ (Trustee Council 2016). The Trustee Council SOP was developed and approved by consensus of the Trustee Council and may be amended as needed. The division of responsibilities among the Trustee Council, TIGs, and individual trustee agencies is summarized in Table 7.2-1 of the Final PDARP/PEIS.

1.3.4 Final PDARP/PEIS Record of Decision

Given the potential magnitude and breadth of restoration for injuries resulting from the DWH Oil Spill, the DWH Trustees prepared a PDARP/PEIS under OPA and NEPA to analyze alternative approaches to implementing restoration and guiding restoration decisions. Based on the DWH Trustees' assessment of impacts to the Gulf of Mexico's natural resources, a comprehensive, integrated ecosystem restoration approach for restoration implementation was proposed. On February 19, 2016, the DWH Trustee Council issued a Final PDARP/PEIS which is intended to help guide DWH restoration implementation and the TIGs on a programmatic level. On March 29, 2016, in accordance with OPA and NEPA, the DWH Trustees published a notice of availability of a ROD for the Final PDARP/PEIS in the *Federal Register* (NOAA Fisheries 2016). Based on the DWH Trustees' injury determination established in the Final PDARP/PEIS, the ROD set forth the basis for the DWH Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative. The DWH Trustees' selection of Alternative A includes the funding allocations outlined in the Final PDARP/PEIS. More information about Alternative A can be found in Sections 5.5 and 5.10 of the Final PDARP/PEIS.

1.3.5 Relationship of this RP/EA to the Final PDARP/PEIS

As a programmatic restoration plan, the Final PDARP/PEIS provides direction and guidance for identifying, evaluating, and selecting future restoration projects to be carried out by the TIGs (see Section 5.10.4 and Chapter 7 of the Final PDARP/PEIS). The DWH Trustees elected to prepare a PEIS to support analysis of the environmental consequences of the selected restoration types, to consider the many related actions that may occur because of restoration planning efforts, and to allow for a better analysis of cumulative impacts of potential actions. The programmatic approach was taken to assist the TIGs in their development and evaluation and to assist the public in its review of future restoration projects. The Final PDARP/PEIS was also developed to support a tiered analysis and decision-making with the anticipation that certain future restoration actions could be undertaken without additional NEPA review, whereas others might proceed based on more focused tiered EAs or EISs. The programmatic approach was taken to assist the DWH Trustees in their development and evaluation of future restoration projects and to assist the public in its review of future restoration projects.

For the Final PDARP/PEIS, the DWH Trustees developed a set of restoration types for inclusion in programmatic alternatives, consistent with the desire to seek a diverse set of projects providing benefits to a broad array of injured natural resources and services. Ultimately, this process resulted in the inclusion of 13 restoration types in five major restoration goals: 1) restore and conserve habitat; 2) restore water quality; 3) replenish and protect living coastal and marine resources; 4) provide and enhance recreational opportunities; and 5) provide for monitoring, adaptive management, and administrative oversight to support restoration implementation (DWH Trustees 2016):

1. Wetlands, Coastal, and Nearshore Habitats
2. Habitat Projects on Federally Managed Lands
3. Nutrient Reduction (Nonpoint Source)
4. Water Quality (e.g., Stormwater Treatments, Hydrologic Restoration, Reduction of Sedimentation, etc.)

5. Fish and Water Column Invertebrates
6. Sturgeon
7. Submerged Aquatic Vegetation
8. Oysters
9. Sea Turtles
10. Marine Mammals
11. Birds
12. Mesophotic and Deep Benthic Communities
13. Provide and Enhance Recreational Opportunities

As mentioned above, the Final PDARP/PEIS was intended to be used to tier the NEPA analysis in the subsequent restoration plans prepared by the TIGs (40 CFR 1502.20; see Chapter 6 of the Final PDARP/PEIS). A tiered environmental analysis is a project-specific analysis that focuses on project-specific issues and summarizes or references (rather than repeats) the broader issues discussed in the Final PDARP/PEIS. This RP/EA is consistent with the Final PDARP/PEIS and ROD and provides a NEPA analysis for each alternative, tiering from the Final PDARP/PEIS where applicable. For this RP/EA, the DWH Trustees considered the extent to which additional NEPA analyses may be necessary for the alternatives that tier their NEPA analyses from the Final PDARP/PEIS. These considerations include whether the analyses of relevant conditions and environmental effects described in the Final PDARP/PEIS are still valid and whether impacts under the alternatives have already been fully analyzed in the Final PDARP/PEIS. The applicable sections of the Final PDARP/PEIS are incorporated by reference into this plan (40 CFR 1502.21).

Section 2 of this RP/EA summarizes the screening process used to develop a reasonable range of alternatives, which is consistent with the DWH Trustees' selected programmatic alternative in the Final PDARP/PEIS, the Consent Decree, and OPA. The LA TIG also prepared a NEPA environmental consequences analysis for the reasonable range of alternatives in this RP/EA (see Section 4), which tiers from the Final PDARP/PEIS programmatic NEPA analysis. The LA TIG used the direction and the guidance of the Final PDARP/PEIS to consider and evaluate alternatives within wetlands, coastal, and nearshore habitat restoration type.

Chapter 5 of the Final PDARP/PEIS analyzes different restoration approaches to address resource injuries for each restoration type. The alternatives evaluated in this RP/EA are consistent with the restoration approaches described in the PDARP/PEIS for the Wetlands, Coastal, and Nearshore Habitat restoration type.

1.3.5.1 WETLANDS, COASTAL, AND NEARSHORE HABITATS

The Wetlands, Coastal, and Nearshore Habitats restoration type is described in Section 5.5.2.2 of the Final PDARP/PEIS. Of the seven restoration approaches identified in this restoration type in the Final PDARP/PEIS, the following four are addressed in this RP/EA:

- **Create, restore, and enhance coastal wetlands.** This restoration approach provides opportunities for coastal habitat restoration to compensate for injuries resulting from the DWH incident. This restoration approach would be implemented to achieve multiple ecosystem benefits and to maximize habitat benefits and may not correspond to specific areas that were directly oiled. Restoration of these habitats at a large scale can provide benefits across the northern Gulf of Mexico ecosystem, which suffered injuries from the spill and associated response activities. Opportunities to restore these habitats and benefit associated resources and services are located throughout the Gulf of Mexico. This restoration approach also emphasizes restoration of wetland complexes for the wide range of ecological functions they provide (see Section 5.5.2 of the Final PDARP/PEIS).

- **Restore oyster reef habitat.** This restoration approach focuses on restoration, creation, and enhancement of oyster (specifically eastern oyster [*Crassostrea virginica*]) reef habitat; resilient oyster populations; and diverse benthic and fish communities. Oysters are considered "ecosystem engineers" for their role in creating reefs that modify, through their physical presence, the surrounding environment while also providing habitat, refuge, and foraging areas for many other species including benthic organisms and fish (Coen and Luckenbach 2000; Powers et al. 2009; VanderKooy 2012; Wong et al. 2011, as cited in Appendix 5.D of the Final PDARP/PEIS). Multiple restoration techniques are available for use, either individually or in combination, as potential restoration projects including the following approaches: restoring or creating oyster reefs through placement of cultch in nearshore and subtidal areas; constructing living shorelines; enhancing oyster reef productivity through spawning stock enhancement projects such as planting hatchery raised oysters, relocating wild oysters to restoration sites, oyster gardening programs, and other similar projects; and developing a network of oyster reef spawning reserves.
- **Create, restore, and enhance barrier and coastal islands and headlands.** This restoration approach focuses on the broad ecological and socioeconomic benefits of many resources that barrier shorelines sustain. Restoring beach areas would improve food and nutrient exchange with aquatic habitats and provide important resting or loafing areas for birds. Back-barrier marshes can provide foraging and refuge habitat for fish, shellfish, and birds, and, additionally, reduce erosion and storm surges, thus benefiting oyster populations and seagrass beds by reducing excessive sedimentation in nearshore waters (Wilber and Clarke 2001, as cited in Section 5.5.2 of the Final PDARP/PEIS).
- **Restore and enhance dunes and beaches.** This restoration approach focuses on the potential to reduce the effects of future storm surges on nearshore wetlands and associated brackish-water resources, particularly where existing dunes have been damaged by prior hurricanes. Dune restoration would help maintain suitable habitat for sea turtle and bird nesting in the face of losses to sea level rise and development along the coasts (see Section 5.5.2 of the Final PDARP/PEIS).

1.3.6 Summary of Injuries Addressed in this RP/EA

According to OPA regulations, injury is "[a]n observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service" (15 CFR 990.30). Types of injuries can include adverse changes in survival, growth, and reproduction; in health, physiology, and biological condition; in behavior; in community composition; in ecological processes and functions; in physical and chemical habitat quality or structure; and in public services.

For the Final PDARP/PEIS, the DWH Trustees conducted an injury assessment under the authority of and in accordance with OPA regulations (33 USC 2701 et seq.; see Chapter 4 of the Final PDARP/PEIS). The injury assessment establishes the nature, degree, and extent of injuries from the DWH incident to both natural resources and the services they provide. Injury assessment results were used to inform restoration planning so that restoration would address the nature, degree, and extent of the injuries. The injury assessment provided in the Final PDARP/PEIS was used to identify restoration goals and subsequent restoration types that addresses the injuries.

A number of different resource categories were evaluated, including injuries to nearshore and shoreline resources, to estuarine coastal wetland complexes, and to sand beaches and also to the services they provide. Section 5.5.2 of the Final PDARP/PEIS provides more detail about the injuries affecting these resources. Injuries were detected over a range of species, communities, and habitats and affected a variety of ecosystem components over many hundreds of miles in the northern Gulf of Mexico. Injuries to nearshore resources have cascading impacts throughout the ecosystem that influence the overall health and productivity of the Gulf of Mexico (see Section 4.6.9 of the Final PDARP/PEIS). These resources include fish and aquatic invertebrates, such as crustaceans and planktonic plants and animals that were exposed to oil in the water column.

Almost all types of nearshore ecosystem habitats in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, including coastal wetlands. In addition to direct impacts caused by oil in the water column, marsh edge habitats were also affected. Animals using the edge of the marsh for refuge and forage were exposed to oil through contact with oiled plants, soil, sediment, and detritus on the marsh surface as it floods with the tide, as well as through ingestion or contact with oil entrained in submerged sediments near the edge. Toxicity testing conducted using marsh soil containing MC252 oil demonstrates that polycyclic aromatic hydrocarbons concentrations found in oiled marsh areas are toxic to many marsh species (Morris et al. 2015, as cited in the Final PDARP/PEIS). The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species and life stages (see Section 4.6 of the Final PDARP/PEIS). Populations of long-lived species (e.g., periwinkle snails, sturgeon) take years to recover normal age and size distributions, even after environmental conditions are no longer toxic. Overall, both direct and indirect impacts to the productivity of wetland, coastal, and nearshore habitats through ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes were experienced.

Coastal Louisiana sustained the most shoreline oiling associated with the DWH incident and is also experiencing substantive ongoing wetland loss in the region (Barras et al. 2008; Couvillion et al. 2011, as cited in the Final PDARP/PEIS). Therefore, the DWH Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the PDARP/PEIS. Further, because the approach to assessing nearshore impacts focused on injury to accessible habitats and species over a limited area and time period, the total injury to the nearshore ecosystem is almost certain to be larger than the sum of the studied components. The DWH Trustees determined it was most appropriate to develop an integrated restoration portfolio, taking into account the important linkages among habitat types and between habitats and injured resources.

1.4 Restoration Purpose and Need

The LA TIG has undertaken this restoration effort to meet the purpose of restoring those natural resources and services injured in the Louisiana Restoration Area as a result of the DWH Oil Spill. Restoration activities are intended to restore or replace habitats, species, and services to their baseline condition (primary restoration) and to compensate the public for interim losses from the time natural resources are injured until they recover to baseline conditions (compensatory restoration). This RP/EA falls within the scope of the purpose and need identified in the Final PDARP/PEIS. As described in Section 5.3 of the Final PDARP/PEIS, the five DWH Trustee programmatic restoration goals work independently and together to benefit injured resources and services. This RP/EA focuses on the restoration of injuries to Louisiana's natural resources and services, with restoration to wetlands, coastal, and nearshore habitats. The alternatives evaluated in this RP/EA address one of the five Trustee programmatic restoration goals: 1) restore and conserve habitat.

Consistent with the Trustee programmatic restoration goals, the Final PDARP/PEIS also identifies goals for each restoration type (see Sections 5.5.2 through 5.5.14 of the Final PDARP/PEIS). These restoration type–specific goals help to guide restoration planning and project selection for each restoration type. To help meet these goals, implementation of this RP/EA would address the Wetlands, Coastal, and Nearshore Habitat restoration type, using the following restoration approaches in the Louisiana Restoration Area: create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beach.

Restoring wetlands, costal, and nearshore habitat includes the following restoration goals:

- Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

The DWH Trustees seek to implement coastal and nearshore wetlands habitat restoration in ways that achieve multiple ecosystem benefits for the large-scale restoration goals. For example, coastal wetlands could be enhanced for juvenile shrimp, crabs, oysters, and some fishes by incorporating open water and marsh edge into the marsh complex (Baltz et al. 1993; Minello et al. 2008; Minello and Rozas 2002; Neahr et al. 2010; Rozas and Minello 2015; Zimmerman et al. 2000, as cited in Section 5.2 of the Final PDARP/PEIS). Benefits could also be maximized by implementing habitat complexes through combining multiple restoration approaches, such as incorporating construction of nearshore oyster reefs or living shorelines into the design of marsh creation projects (Baillie et al. 2015; Boström et al. 2011; Dorenbosch et al. 2004; Grabowski et al. 2005; Hitt et al. 2011; Hosack et al. 2006; Irlandi and Crawford 1997; Micheli and Peterson 1999, as cited in section Chapter 5.2 of the Final PDARP/PEIS).

Coastal and nearshore habitats integrate and form a continuum within the nearshore ecosystem and contribute to an integrated, connected food web (Baillie et al. 2015; Boesch and Turner 1984; Boström et al. 2011; Deegan 1993; Deegan et al. 2000; Nelson et al. 2011; Nelson et al. 2013, as cited in the Final PDARP/PEIS). Because this critical role was disrupted by injuries to these habitats and their associated resources, this restoration approach is intended to be implemented across the Gulf and address multiple ecosystem benefits through habitat restoration. The DWH Trustees have indicated that identifying opportunities to restore multiple habitats within one project, or to implement multiple projects within a given area, may accelerate recovery of injured ecosystem functions and achieve a more integrated restoration of the nearshore ecosystem and its service flows.

1.5 Proposed Action: Implementation of the LA TIG Restoration Plan and Environmental Assessment #6

To address the DWH Trustees' programmatic and restoration type goals described in the Final PDARP/PEIS, the LA TIG proposes to undertake the planning and implementation of the three projects identified as preferred alternatives in this RP/EA to restore wetlands, coastal, and nearshore habitats in Louisiana using funds made available through the DWH Consent Decree. A detailed description of each of the alternatives considered in this RP/EA is provided in Section 3.

1.6 Alternatives Considered in the Restoration Plan and Environmental Assessment

In total, the LA TIG evaluated four different action alternatives and a No Action Alternative as the reasonable range of alternatives in this RP/EA. These alternatives are intended to contribute to restoration and conservation of wetlands, coastal, and nearshore habitats in the Louisiana Restoration Area. Through the alternative evaluation process described in the remainder of this document, the LA TIG identified three projects as preferred alternatives. Table 1.6-1 presents the alternatives evaluated and which of those alternatives are preferred for implementation. The locations of the reasonable range of alternatives are shown in Figure 1.6-1.

Table 1.6-1. Alternatives Considered in this Restoration Plan and Environmental Assessment

Alternative	Parish	Summary	Preferred Alternative
West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	Create and restore beach habitat, dune habitat, and intertidal marsh habitat and protect shoreline along Barataria Pass and Barataria Bay on the western side of West Grand Terre Island.	Yes
Golden Triangle Marsh Creation	Orleans and St. Bernard	Create or restore broken marsh and open water through construction of containment dikes to help buffer surge barrier and provide estuarine habitat for Lake Borgne.	Yes
Biloxi Marsh Living Shoreline	St. Bernard	Create oyster barrier reef along eastern shore of Biloxi Marsh to provide oyster habitat, reduce erosion, and prevent further marsh deterioration.	Yes
Fifi Island Forested Ridge with Breakwater	Jefferson	Create coastal forested ridge to provide critical habitat and protect Barrier Islands from storm surges.	No

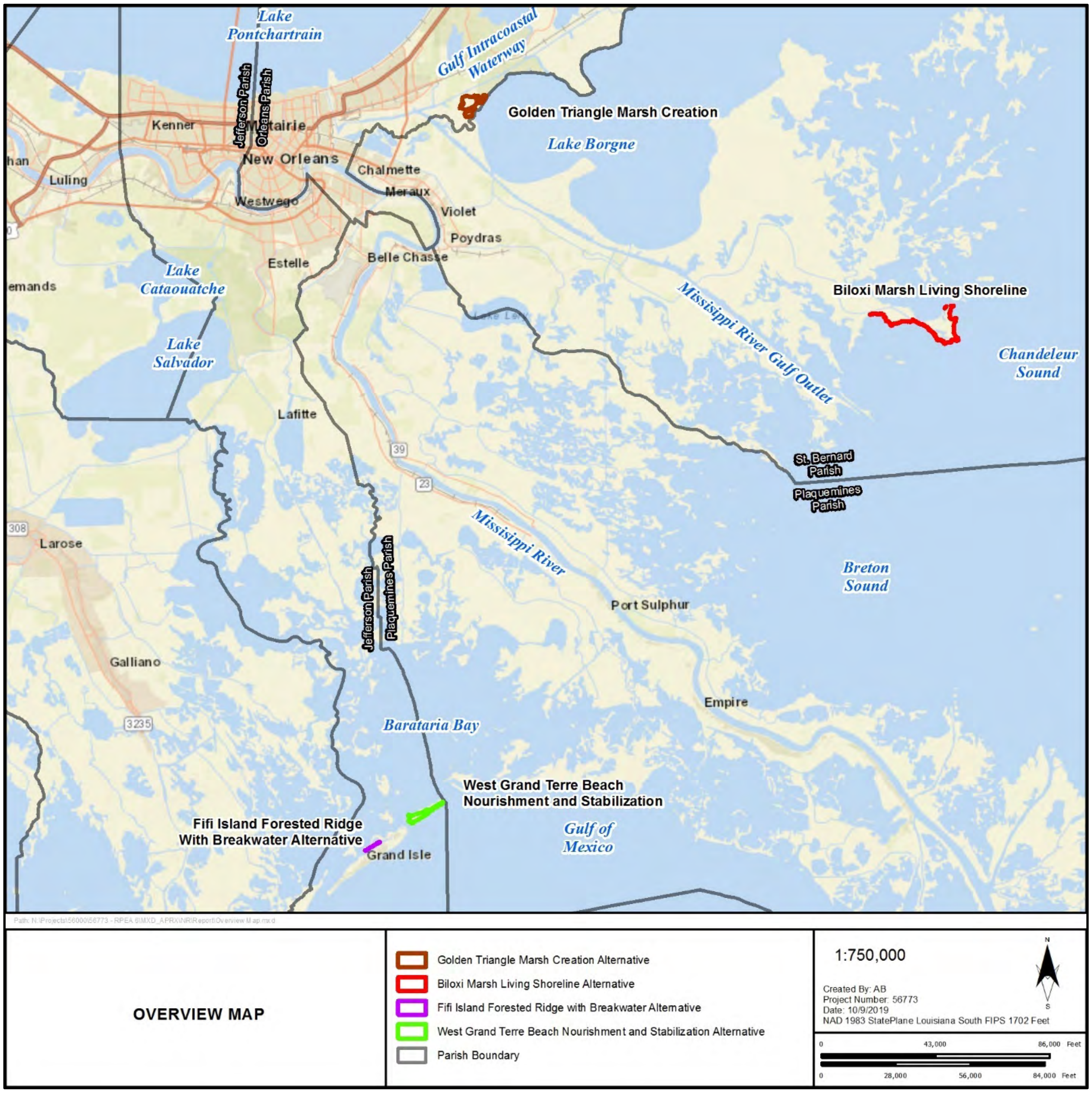

Figure 1.6-1. Alternatives overview.

1.7 Severability of Projects

In this RP/EA, the LA TIG proposes to select preferred restoration alternatives with a total funding of approximately $209,798,020 million. If the preferred restoration alternatives are selected, there would be a remaining approximate balance of $3,766,231,448 for the Wetlands, Coastal, and Nearshore Habitat restoration type. The restoration projects are independent of each other and may be selected independently for implementation in this and/or future restoration plans by the LA TIG.

1.8 Relationship to Other Plans, Policy, or Actions

Because of the magnitude of the DWH Oil Spill, the DWH Trustees began planning for and implementing Early Restoration projects with funding from BP before the oil spill's injury assessment was complete and before the entry of the Consent Decree. Early Restoration occurred in five separate phases, during which Early Restoration plans were prepared and associated NEPA compliance was completed. These Early Restoration activities are a subset of the extensive, continuing effort needed to address complete restoration of injuries to natural resources resulting from the DWH Oil Spill.

To date, the LA TIG has released seven restoration plans to the public:

1. *LA TIG Final Restoration Plan #1: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; and Birds*, which selects six restoration alternatives for E&D: two bird island projects (Queen Bess and Rabbit Island Restoration), three coastal wetlands projects (Terrebonne Basin Ridge and Marsh Creation Project: Bayou Terrebonne Increment; Barataria Basin Ridge and Marsh Creation Project: Spanish Pass Increment; and Lake Borgne Marsh Creation Project: Increment One), and one habitat project on federally managed lands (Shoreline Protection and Jean Lafitte National Park and Preserve) (LA TIG 2017).
2. *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities*, reallocated the Early Restoration funds earmarked for Louisiana Marine Fisheries Enhancement, Research, and Science Center to four projects intended to provide and enhance recreational use (LA TIG 2018a).
3. *LA TIG Final Strategic Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in Barataria Basin, Louisiana* was prepared to identify a restoration strategy that will help prioritize future decisions regarding project selection and funding in Barataria Basin, Louisiana (LA TIG 2018b).
4. *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #4: Nutrient Reduction (Nonpoint Source) and Recreational Use* was prepared to improve water quality by reducing nutrients from nonpoint sources to and compensate for recreational use services lost as a result of DWH Oil Spill (LA TIG 2018c).
5. *Louisiana Trustee Implementation Group Supplemental Restoration Plan and Environmental Assessment for the Elmer's Island Access Project Modification* (LA TIG 2018d) was prepared to assess the environmental impacts from the modification to the originally proposed Elmer's Island Access project, which was included in the *Draft Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities* (LA TIG 2018e).
6. *Louisiana Trustee Implementation Group Final Phase 2 Restoration Plan and Environmental Assessment #1.1: Queen Bess Island Restoration* was prepared to restore habitat for birds injured by the DWH Oil Spill by providing suitable colonial waterbird nesting and brood-rearing habitat on Queen Bess Island (LA TIG 2019a).
7. *Louisiana Trustee Implementation Group Supplemental Restoration Plan and Environmental Assessment for the Lake Charles Science Center and Educational Complex Project Modification* (LA TIG 2019b) was prepared to assess the environmental impacts from modifications to the Lake Charles Science Center and Educational Complex project that was originally selected in the *Final Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities* (LA TIG 2018a).

In addition to NRDA-funded restoration, there are two other funding sources specifically intended to address DWH restoration on the Gulf Coast: 1) the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund (GEBF) and 2) the Resources and Ecosystems Sustainability, Tourism Opportunities, and Revived Economy of the Gulf Coast Act of 2011 (RESTORE Act). In 2016, the Gulf

Coast Ecosystem Restoration Council (RESTORE Council) released its 2016 comprehensive plan update, which prioritizes "Large-scale projects and programs that are projected to substantially contribute to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast ecosystem" (RESTORE Council 2016: 15). The RESTORE Council believes advancing large-scale solutions at the regional scale can be optimized through the synergy of multiple connected projects or a single large project or program and facilitated through collaboration with NRDA, NFWF, and/or other federal funding programs.

The GEBF funds projects benefiting the natural resources of the Gulf Coast that were impacted by the spill and has directed a total of $2.544 billion to be spent over a 5-year period, with $625 million allocated for projects in the State of Louisiana thus far. NFWF prioritizes projects in accordance with plea agreements that came out of the DWH Oil Spill settlement that are designed to "remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources" (NFWF 2014). The five Gulf Coast states have submitted various proposals to NFWF for GEBF awards. NFWF is responsible for evaluating and determining that project proposals align with GEBF funding priorities that should contribute significantly to the following natural resource outcomes (NFWF 2014):

- Restore and maintain the ecological functions of landscape-scale coastal habitats, including barrier islands, beaches, and coastal marshes, and ensure their viability and resilience against existing and future threats, such as sea level rise
- Restore and maintain the ecological integrity of priority coastal bays and estuaries
- Replenish and protect living resources, including oysters, red snapper and other reef fishes; Gulf Coast bird populations; and sea turtles and marine mammals

In Louisiana, the plea agreements required that the funds be allocated solely to barrier island restoration projects and river diversion projects along the Mississippi and Atchafalaya Rivers (CPRA 2013).

1.9 Louisiana Trustee Implementation Group Public Participation

The LA TIG issued a notice of solicitation (NOS) to the public on June 7, 2019, to request submission of project ideas through July 5, 2019 (Appendix A). On July 19, 2019, the LA TIG issued a notice of intent informing the public that it was initiating the drafting of a restoration plan to restore and conserve wetlands, coastal, and nearshore habitats caused by the DWH Oil Spill. Project ideas were considered and evaluated through a project screening process, and a reasonable range was developed as a result of that process.

1.9.1 Comment Period and Public Webinar Information

The public is encouraged to review and comment on this RP/EA. Following public notice, this RP/EA will be available to the public for a 30-day comment period. The deadline for submitting written comments on this RP/EA is specified in the public notice published in the *Federal Register*, the *Louisiana Register*, and on the NOAA Restoration portal. Comments must be postmarked no later than 30 days after the start of the comment period. Comments on this RP/EA can be submitted during the comment period by one of following methods:

Online: http://www.gulfspillrestoration.noaa.gov/restoration-areas/louisiana

By mail (hard copy), addressed to the following:
U.S. Fish and Wildlife Service
P.O. Box 29649
Atlanta, Georgia 30345

Public webinar: To facilitate public review and comment on the RP/EA, the LA TIG will host a public webinar on Wednesday, January 8, 2020, from 12 p.m. to 1 p.m. Central Standard Time. The public may register for the webinar at https://attendee.gotowebinar.com/register/8527752114619805195. After registering, participants will receive a confirmation email with instructions for joining the webinar. The public webinar will include a presentation on this RP/EA. Public comments will be taken during the public webinar. The presentation will be posted on the internet shortly after the webinar is conducted.

Please note that personal identifying information included in submitted comments (e.g., address, telephone number, email address) may be made publicly available.

1.9.2 Decision to be Made

The intent of this RP/EA is to provide the public and decision makers with the information and analysis needed to enable meaningful review and comment on the LA TIG's proposal to proceed with the selection and implementation of one or more of the alternatives proposed in this plan. Projects not identified for inclusion in the Final RP/EA may be considered for inclusion in future restoration plans.

1.9.3 Administrative Record

The DWH Trustees opened a publicly available administrative record for the NRDA for the DWH Oil Spill, including restoration planning activities, concurrently with publication of the 2010 N notice of intent (pursuant to 15 CFR 990.45). DOI is the federal trustee that maintains the administrative record, which can be found online at http://www.doi.gov/deepwaterhorizon/adminrecord. This administrative record site is also used by the LA TIG for DWH restoration planning.

Information about restoration project implementation is provided to the public through the administrative record and other outreach efforts, including online at http://www.gulfspillrestoration.noaa.gov.

1.10 Document Organization

This section describes the organization of this RP/EA, which consists of Sections 1 through 9 and six appendices.

- Section 1 (Introduction): Introductory information and context for this RP/EA, background on the NRDA restoration planning process, summary of injuries to resources resulting from the DWH Oil Spill addressed in this RP/EA
- Section 2 (Restoration Planning Process): Identification and evaluation of alternatives to restore and conserve wetlands, coastal, and nearshore habitat
- Section 3 (Oil Pollution Act Evaluation of Alternatives): Evaluation of the alternatives proposed for NRDA restoration against criteria set forth in OPA, and proposal of a suite of preferred restoration alternatives
- Section 4 (Environmental Assessment): Description of the affected environment and the environmental consequences for each of the alternatives evaluated in this RP/EA
- Section 5 (Cumulative Impacts): Description of the cumulative impacts of the alternatives when added to other past, present, and reasonably foreseeable future actions
- Section 6 (Compliance with Other Laws and Regulations): Identification and description of other federal and state laws, in addition to the requirements of OPA and NEPA, that may apply to the preferred alternatives in this RP/EA

- Section 7 (List of Preparers and Reviewers): Identification of individuals who substantively contributed to the development of this RP/EA
- Section 8 (List of Repositories): A list of facilities that received copies of this RP/EA for review by the public
- Section 9 (Literature Cited): A list of references used to write and support the analysis in this RP/EA

2 RESTORATION PLANNING PROCESS

The restoration planning process started prior to the DWH Oil Spill settlement with BP and issuance of the Final PDARP/PEIS, and this RP/EA represents a continuation of that restoration planning process. Previous steps taken in this process included assessing the injury from the DWH Oil Spill, developing restoration projects as part of the Early Restoration program undertaken jointly by the DWH Trustees and BP, and planning for programmatic restoration as part of the Final PDARP/PEIS. Upon completion of the settlement with BP, the DWH Trustees created the LA TIG to implement comprehensive DWH restoration planning in Louisiana.

NRDA restoration under OPA is a process that includes evaluating injuries to natural resources and their services to determine the type and extent of restoration needed to address those injuries. Restoration activities need to produce benefits that are related to or have a nexus to the natural resources or their services impacted by an oil spill. Under the OPA NRDA regulations (15 CFR 990.54), trustees are to identify and evaluate a reasonable range of alternatives based on criteria outlined within that subsection. The OPA NRDA regulations provide criteria for use by trustees to evaluate projects designed to compensate the public for injuries caused by oil spills. In accordance with the OPA NRDA regulations (15 CFR 990.53), the LA TIG developed a screening process to identify a reasonable range of alternatives to be further evaluated in this plan.

This section describes the screening process used by the LA TIG to identify the reasonable range of alternatives in this RP/EA under the OPA NRDA regulations (15 CFR 990.53). The reasonable range of alternatives is consistent with the PDARP/PEIS (described in Section 1). This section summarizes the restoration decisions stated in the PDARP/PEIS and ROD, the relationship of the PDARP/PEIS to this RP/EA, injuries addressed, and the projects considered in the reasonable range of alternatives. The restoration planning process was conducted in accordance with OPA, NEPA, Consent Decree, Trustee SOPs, and the OPA NRDA and NEPA regulations.

2.1 Project Screening and Reasonable Range of Alternatives

The goal of the LA TIG's screening process was to identify a reasonable range of alternatives suitable for addressing injuries to natural resources and their services in Louisiana caused by the DWH Oil Spill. In developing a reasonable range of alternatives suitable for addressing the injuries caused by the incident, the LA TIG reviewed the DWH Trustees' programmatic restoration goals and restoration type–specific goals specified in the Final PDARP/PEIS (see Section 1.3.5.1 of this RP/EA). The LA TIG also considered other criteria identified in the Final PDARP/PEIS, including screening factors in the OPA regulations (15 CFR 990.54), input from the public, the current and future availability of funds under the DWH NRDA settlement payment schedule, as well as projects already fully funded or proposed to be fully funded by the other DWH restoration funding sources (NFWF GEBF and the RESTORE Act) and other non-DWH restoration funding sources and applicant-matching funds.

2.2 Summary of Alternatives Considered but not Carried Forward for Further Evaluation in this RP/EA

The LA TIG issued an NOS to the public on June 7, 2019, to request submission of project ideas through July 5, 2019 (see Appendix A) to either of the following:

- Trustee Portal, available at: https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/suggest-a-restoration-project)
- State of Louisiana Portal (State Portal), available at: https://la-dwh.com/project-submission/

In all, six projects were submitted to the portals in response to the NOS.

The NOS also provided the following:

- Information on the geographic locations where restoration activities would be considered: Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes in Louisiana
- Four restoration approaches to address the Wetlands, Coastal, and Nearshore Habitat restoration type in this RP/EA:
  - Create, restore, and enhance coastal wetlands
  - Restore oyster reef habitat
  - Create, restore, and enhance barrier and coastal islands and headlands
  - Restore and enhance dunes and beach
- Criteria on project readiness:
  - Request that project proposals be ready for construction within 12 to 18 months of issuance of the NOS on June 7, 2019
  - Request that project readiness include consideration of environmental compliance and/or E&D that is already underway

The LA TIG also queried existing projects that had been uploaded by the public to both the Trustee and State Portals to identify projects that could be eligible for consideration in this RP/EA and to ensure that a reasonable range of alternatives would be analyzed. All project ideas submitted to the Trustee and State Portals and by various state and federal agencies (herein referred to as the Project Universe) were reviewed and screened for eligibility using the following criteria:

- Projects must be located in the Louisiana Restoration Area.
- Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill.
- Project must not be identified for or receiving complete project funding relative to the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.

2.2.1 Project Universe

Based on the query output from the Trustee and State Portals as well as responses to the NOS, the LA TIG assembled an initial list of project alternatives for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type. The project alternative universe (i.e., the project universe) comprised 380 projects that underwent a four-step screening as part of the restoration planning process. Appendix B lists the comprehensive project universe for this restoration type, and Table 2.2-1 lists and describes the four screening steps and criteria.

Table 2.2-1. Screening Criteria Applied to the Project Universe

Screening Step	Criteria	Screening Notes
Step 1: Eligibility Screening	1. Projects must be located in the Louisiana Restoration Area. 2. Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill. 3. Projects must not be identified form or receiving complete project funding relative tom the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.	Many projects considered under Step 1 did not meet all of the Step 1 criteria and were removed from further consideration. This included projects that were uploaded to the portals in the wrong restoration type (i.e., they were not in the Wetlands, Coastal, and Nearshore Habitats restoration type), duplicate projects, or projects that did not meet the definition of *project* as described in the Final PDARP/PEIS.
Step 2: NOS Initial Screening	1. Projects must be located in the Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, or St. Bernard Parishes. 2. Projects must meet at least one of the restoration approaches outlined in the NOS: • Create, restore, and enhance coastal wetlands • Restore oyster reef habitat • Create, restore, and enhance barrier and coastal islands and headlands • Restore and enhance dunes and beach 3. Projects must be ready for construction within 12 to 18 months of the projects' submission to the Trustee or State Portal. 4. Projects must have environmental compliance and E&D that are already complete or underway.	Projects that moved from Step 1 to Step 2 screening had to meet all four Step 2 NOS screening criteria to be eligible for consideration in Step 3. Many projects met the geographic location criteria and were the correct restoration type, but many of those did not meet the project construction readiness or environmental compliance criteria.
Step 3: OPA Screening Criteria	1. Is the cost to carry out the project reasonable? 2. Is the project expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses? 3. Is the project likely to succeed? 4. Will the project prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative? 5. Will the project benefit more than one natural resource and/or service? 6. Will the project benefit, and avoid collateral injury on, public health and safety?	Projects that moved to Step 3 were then screened using the six OPA criteria questions. Projects at this step required an affirmative response to all six questions to move to Step 4 screening.
Step 4: Specific Screening Considerations of the LA TIG	1. Is the project consistent with the goals and objectives in Louisiana's coastal master plan (CPRA 2017a)? 2. Is the project complementary to other restoration projects in the region/area? 3. To what extent does the project protect or restore a complex of habitats (e.g., project restores for multiple types of habitat, such as beach, dune, and marshes) within the nearshore ecosystem and therefore contribute to an integrated, connected food web? 4. Will the project contribute to habitat protection or near other projects proposed for selection in this plan, thereby achieving a greater overall benefit to nearshore habitats? 5. Is the project adjacent to land uses that would pose a threat to the benefits of the restoration project? 6. Are there other funds that can be leveraged in conjunction with NRDA funds to allow for implementation? 7. Are there any other impediments to carrying the project forward as part of the reasonable range of alternatives designated for more detailed OPA and NEPA analysis (e.g., compliance issues)?	Projects that were evaluated at Step 4 received scores (1 = yes and 0 = no) for all yes/no questions 1, 4, 5, 6, and 7. For the more involved questions 2 and 3, projects were scored on a 1–5 basis: 1 = no; 2 = uncertain; 3 = somewhat; 4 = moderately; 5 = very.

2.3 Reasonable Range of Alternatives

The LA TIG's decisions to advance projects to the reasonable range of alternatives were based on applying the criteria that were developed and approved by the LA TIG (see Table 2.2-1). The criteria were carefully developed to ensure that projects that could be advanced would provide the greatest benefits to the specific resources injured along the Louisianan Gulf Coast in the DWH Oil Spill identified in the NOS. In other words, the LA TIG identified the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type as the focus of the restoration plan and developed screening criteria with that in mind. Alternatives carried forward in the reasonable range showed they could meet this restoration type focus effectively and in a timely fashion. The LA TIG developed the screening criteria to select projects that would provide the greatest benefits to the Louisiana Restoration Area. Table 2.3-1 indicates the number of projects screened at each step. It should be noted that projects screened out at any step remain in the Trustee and State Portals and would be eligible as applicable for future restoration planning efforts.

Table 2.3-1. Number of Projects Screened

Screening Step	Number of Projects Screened	Number of Projects Moved to Next Step
Step 1: Eligibility Screening	380	104
Step 2: NOS Initial Screening	104	7
Step 3: OPA Screening Criteria	7	7
Step 4: Specific Screening Considerations of the LA TIG	7	4

2.3.1 Step 1: Eligibility Screening

The Step 1 screening process looked at all projects that had been uploaded by the public to both the Trustee and State Portals, including those projects submitted with the June 7, 2019 NOS.

Projects in Step 1 had to meet the following criteria:

- Projects must be located in the Louisiana Restoration Area.
- Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill.
- Projects must not be identified for or receiving complete project funding relative to the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.

In all, 380 projects were identified and carried forward for the initial screening in Step 1. Many projects considered under Step 1 did not meet all of the Step 1 criteria and were removed from further consideration. This included projects that were uploaded to portal in the wrong restoration type (i.e., they were not in the Wetlands, Coastal, and Nearshore Habitats restoration type), duplicate projects, or projects that did not meet the definition of *project* as described in the Final PDARP/PEIS. Projects uploaded to the wrong project category remain in the portals and would turn up in queries conducted for future restoration plan development.

2.3.2 Step 2: NOS Initial Screening

Projects brought forward to Step 2 had to meet the following criteria:

- Projects must be located in the Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, or St. Bernard Parishes.
- Projects must meet at least one of the restoration approaches outlined in the NOS:
  - Create, restore, and enhance coastal wetlands
  - Restore oyster reef habitat
  - Create, restore, and enhance barrier and coastal islands and headlands
  - Restore and enhance dunes and beach
- Projects must be ready for construction within 12 to 18 months of the projects' submission to the Trustee or State Portal.
- Projects must have environmental compliance and E&D that are already complete or underway.

Projects that moved from Step 1 to Step 2 screening had to meet all four Step 2 criteria to be eligible for consideration in Step 3. Of the 104 projects that were carried over to Step 2, 94 did not meet three or more criteria and were excluded from further screening. In all, 25 projects did not meet two or more criteria and were excluded from further screening. In all, 20 projects were excluded based on not meeting only one of the criteria, but in order to go on to Step 3, all four criteria questions required a score of (or yes to the question posed). Most projects were excluded based on project readiness for construction; 21 projects were excluded based on geographic location criteria, another six were excluded based on not meeting restoration type criteria and the remainder (70) were excluded due either to project readiness or environmental compliance issues.

2.3.3 Step 3 OPA Screening Criteria

Step 3 asked the following six questions of the projects brought forward from Step 2:

1. Is the cost to carry out the project reasonable?
2. Is the project expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses?
3. Is the project likely to succeed?
4. Will the project prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative?
5. Will the project benefit more than one natural resource and/or service?
6. Will the project benefit, and avoid collateral injury on, public health and safety?

Projects that moved to Step 3 were then screened using the six OPA criteria questions. Projects at this step required an affirmative response to all six questions to move to Step 4.

2.3.4 Step 4: Specific Screening Considerations of the LA TIG

Step 4 asked the following seven questions from the projects brought forward from Step 3:

1. Is the project consistent with the goals and objectives in Louisiana's coastal master plan (CPRA 2017a)?
2. Is the project complementary to other restoration projects in the region/area?
3. To what extent does the project protect or restore a complex of habitats (e.g., project restores for multiple types of habitat, such as beach, dune, and marshes) within the nearshore ecosystem and therefore contribute to an integrated, connected food web?
4. Will the project contribute to habitat protection or near other projects proposed for selection in this plan, thereby achieving a greater overall benefit to nearshore habitats?
5. Is the project adjacent to land uses that would pose a threat to the benefits of the restoration project?
6. Are there other funds that can be leveraged in conjunction with NRDA funds to allow for implementation?
7. Are there any other impediments to carrying the project forward as part of the reasonable range of alternatives designated for more detailed OPA and NEPA analysis (e.g., compliance issues)?

Projects that were evaluated at Step 4 received scores (1 = yes and 0 = no) for all yes/no questions 1, 4, 5, 6, and 7. For the more involved questions 2 and 3, projects were scored on a 1–5 basis: 1 = no; 2 = uncertain; 3 = somewhat; 4 = moderately; 5 = very. Table 2.3-2 depicts the restoration projects that were carried forward for screening under Step 4.

Table 2.3-2. Alternatives Carried Forward to Step 4

Project Proponent	Alternative	Parish	Screening Evaluation
CPRA	Barataria Bay Rim Marsh Creation	Jefferson and Plaquemines	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.
CPRA	West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	This project and the Biloxi Marsh Living Shoreline project received the highest score (total of 15) of all seven projects that were carried forward to Step 4. Only these two projects received a score of 5 for question 3 and contribute substantively to a continuum of habitats.
Lafourche Parish Government	Bayou Lafourche Marsh Creation	Lafourche	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.
CPRA	Golden Triangle Marsh Creation	Orleans and St. Bernard	This project received a 1 (yes) for all yes/no questions. It received a score of 3 for Question 3 regarding its ability to contribute substantively to a continuum of habitats and a total score of 13.
St. Bernard Parish	Lake Lery Marsh Creation	St. Bernard	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.

Project Proponent	Alternative	Parish	Screening Evaluation
CPRA	Biloxi Marsh Living Shoreline	St. Bernard	This project and the West Grand Terre Beach Nourishment and Stabilization project received the highest score (total of 15) of all seven projects that were carried forward to Step 4. Only these two projects received a score of 5 for question 3 and contribute substantively to a continuum of habitats.
Jefferson Parish	Fifi Island Forested Ridge with Breakwater	Jefferson	This project received a 1 (yes) for all yes/no questions. It received a score of 3 for question 3 regarding its ability to contribute substantively to a continuum of habitats and a total score of 13.

The four highest-scoring projects (alternatives) were carried forward to represent the reasonable range of alternatives for this RP/EA (Table 2.3-3). These projects all received a score of 13 or higher and represent the reasonable range of alternatives for this RP/EA.

Table 2.3-3. Reasonable Range of Alternatives Carried Forward in this RP/EA

Project Proponent	Alternative	Parish
CPRA	West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines
CPRA	Golden Triangle Marsh Creation	Orleans and St. Bernard
CPRA	Biloxi Marsh Living Shoreline	St. Bernard
Jefferson Parish	Fifi Island Forested Ridge with Breakwater	Jefferson

2.4 Natural Recovery/No Action Alternative

As required by OPA regulations, the Final PDARP/PEIS considers a "natural recovery alternative in which no human intervention would be taken to directly restore injured natural resources and services to baseline" (15 CFR 990.53[b][2]). Under a natural recovery alternative, no additional restoration would be done by the Trustees to accelerate the recovery of injured natural resources or to compensate for lost services. The Trustees would allow natural recovery processes to occur, which could result in one of four outcomes for injured resources: 1) gradual recovery, 2) partial recovery, 3) no recovery, or 4) further deterioration. Although injured resources could presumably recover to baseline or near-baseline conditions under this scenario, recovery would take much longer compared to a scenario in which restoration actions are undertaken. The Final PDARP/PEIS (DWH Trustees 2016: 5-92) notes that interim losses of natural resources, and the services natural resources provide, would not be compensated under a natural recovery alternative. Given that technically feasible restoration approaches are available to compensate for interim natural resource and service losses, the Trustees rejected this alternative from further OPA evaluation within the Final PDARP/PEIS. Based on this determination, tiering this RP/EA from the Final PDARP/PEIS, and incorporating that analysis by reference, the LA TIG did not evaluate natural recovery as a viable alternative under OPA. Natural recovery is not considered further in this RP/EA. For these reasons, the LA TIG rejects the natural recovery/no action alternative as a viable means of compensating the public for the lost recreational use and water quality injuries caused by the DWH Oil Spill.

NEPA requires consideration of a no action alternative as a basis for comparison of potential environmental consequences of the action alternative(s). Therefore, a no action alternative is evaluated within the EA portion of this RP/EA. The no project (no action) analysis presents the conditions that would result if the LA TIG did not undertake any additional restoration for injured natural resources or to compensate for lost services at this time. The environmental consequences of such an alternative are evaluated in Section 4.7 for comparison with the remaining alternatives.

3 OIL POLLUTION ACT EVALUATION OF ALTERNATIVES

3.1 Introduction

According to the NRDA regulations under OPA, trustees are responsible for identifying a reasonable range of alternatives (15 CFR 990.53[a][2]) that can be evaluated based on the OPA evaluation standards (15 CFR 990.54). Section 2 describes the screening and identification of a reasonable range of alternatives for evaluation under OPA. Once a reasonable range of alternatives is developed, the OPA NRDA regulations (15 CFR 990.54) require trustees to identify preferred restoration alternatives based on the following criteria:

- **Project costs:** The cost to carry out the alternative
- **Trustee restoration goals and objectives:** The extent to which each alternative is expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses (the ability of the alternative to provide comparable resources and services; that is, the nexus between the project and the injury)
- **Likelihood of success:** The likelihood of success of each alternative
- **Prevent future injury and avoid collateral injury:** The extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury as a result of implementing the alternative
- **Benefits to multiple resources:** The extent to which each alternative benefits more than one natural resource and/or service
- **Public health and safety:** The effect of each alternative on public health and safety

If the DWH Trustees conclude that two or more alternatives are equally preferable, the most cost-effective alternative must be chosen (15 CFR 990.54(b)).

The following section describes the considerations the LA TIG included when performing the OPA evaluation of these alternatives. This evaluation process follows the OPA criteria found in 15 CFR 990.54(a), as well as the Final PDARP/PEIS and public comments. This evaluation is separate from the Step 3 preliminary OPA screening process detailed in Section 2.3 that was used to develop the reasonable range of alternatives. For each alternative, the OPA criteria are evaluated independently, and a determination is made on how well the alternative meets that element. The LA TIG applied each of the OPA criteria to the reasonable range of alternatives in this section to provide 1) a summary explanation of the types of questions and analysis raised under each of the OPA criteria, and 2) a narrative summary of each alternative's evaluation with respect to those criteria.

3.1.1 Summary of Oil Pollution Act Evaluation Criteria

3.1.1.1 PROJECT COSTS

The following questions were asked in the evaluation of each alternative as it pertains to cost effectiveness:

- Is there a description of the anticipated costs of the alternative?
- Are the costs of the alternative (including land acquisition, design, construction, management, monitoring, and maintenance) reasonable, appropriate, and comparable to other equivalent restoration projects?

The cost provided for each alternative is the estimated NRDA-funded cost to implement the alternative. This cost reflects current cost estimates developed from the most current designs and information available to the LA TIG at the time of drafting this RP/EA. The estimated cost could include provisions for planning, E&D, construction, monitoring, trustee oversight, and contingencies.

3.1.1.2 TRUSTEE RESTORATION GOALS AND OBJECTIVES

The LA TIG analyzed the extent to which each alternative is expected to meet the following three restoration goals for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type as described in the Final PDARP/PEIS:

- Restore a variety of interspersed and ecologically connected coastal habitats.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- Restore habitats in appropriate combinations for any given geographic area.

To complete this analysis, the LA TIG evaluated the nature, magnitude, and distribution of benefits expected to be provided to the public by each alternative. At the current stage of development of alternatives considered in this RP/EA, the LA TIG does not have detailed modeling for benefits associated with food web dynamics and nutrient cycling. Therefore, the LA TIG used the amount of habitat created and sustained as the primary measure of benefit for each alternative, following the methods used in *Strategic RP/EA #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in the Barataria Basin* (LA TIG 2018b). Measures of the nature of benefits include the type of habitat created; measures of magnitude of benefits can include number of acres of habitat created by the individual project examples within each alternative.

3.1.1.3 LIKELIHOOD OF SUCCESS

The likelihood of success for each alternative was analyzed using a series of questions:

- Does the alternative propose restoration approaches or techniques that have been previously executed successfully?
- Has the alternative been modeled using best available science?
- For novel or new techniques, has the LA TIG incorporated any measures to minimize risk?
- Has the LA TIG considered the uncertainties influencing success and any adaptive management approaches that would address those uncertainties?
- Will the alternative be resilient to expected future environmental change?

3.1.1.4 PREVENT FUTURE INJURY AND AVOID COLLATERAL INJURY

The extent to which each alternative would prevent future injury (a result of the incident) and avoid collateral injury (a result of implementing the alternative) was analyzed using the following question:

- Does the restoration alternative have direct or indirect collateral environmental impacts?

These considerations are included in the following analysis of alternatives. A more detailed impact analysis is included in the affected environment and environmental consequences sections of this RP/EA (Section 4).

3.1.1.5 BENEFITS TO MULTIPLE RESOURCES

Although each alternative is funded exclusively from one restoration type allocation, the LA TIG considered the importance of multiple resource benefits. This is done by evaluating whether alternatives convey multiple ecosystem service benefits (in addition to restoration of wetlands, coastal, and nearshore habitats) that make them more valuable to the public (e.g., non-use [ecological] values, storm-protection benefits, and habitat and resource improvements that may benefit ecological resources injured by the DWH Oil Spill).

Restoration of coastal marsh provides benefits to the extensive network of natural resources that depend on coastal marshes for all or part of their lifecycle. At the current stage of development of most individual projects considered in this RP/EA, the LA TIG does not have the benefit of detailed modeling for benefits associated with food web dynamics and nutrient cycling. Therefore, the LA TIG used the type(s) and amount of habitat created and sustained as the primary measure of benefit for each alternative, which will benefit the natural resources that depend on these habitats, such as estuarine-dependent water-column resources, and contribute to the overall health of the northern Gulf of Mexico ecosystem. Projects that provided two or more coastal or nearshore habitat and created greater amounts of habitat were scored higher during the alternatives screening process. Projects with the highest evaluation scores were selected for further analysis in this RP/EA.

3.1.1.6 PUBLIC HEALTH AND SAFETY

The LA TIG considered whether there are any aspects of each alternative that could adversely affect public health and safety that cannot be mitigated.

3.1.2 Considerations for all Alternatives

For all alternatives,

- best management practices (BMPs) are discussed in Section 4 as they are relevant to avoiding adverse impacts to the physical, biological, and/or socioeconomic environment, and these BMPs are included as Appendix C;
- MAM plans for the alternatives are in Appendix D; and
- construction schedule(s) are included in this section; however, estimated construction timeframes may be refined during final alternative design.

3.2 Oil Pollution Act Evaluation of Reasonable Range of Alternatives

3.2.1 West Grand Terre Beach Nourishment and Stabilization Alternative

3.2.1.1 ALTERNATIVE DESCRIPTION

Overview

The West Grand Terre Beach Nourishment and Stabilization alternative (hereinafter the *alternative* or the *West Grand Terre alternative*) is in Jefferson Parish and Plaquemines Parish, Louisiana (Figure 3.2-1). West Grand Terre Island is approximately 47 miles south of New Orleans, Louisiana. It is flanked by Grand Isle to the west and East Grand Terre Island to the east. West Grand Terre Island is part of a larger barrier shoreline chain that separates Barataria Bay from the Gulf of Mexico.

The goals of the alternative are as follows:

1. Restore the beach by adding sand to widen the existing beach.
2. Restore the dune system and plant native vegetation to help retain sand on the dune.
3. Create a back-barrier marsh on the west end of the West Grand Terre Island to serve as a rollover platform and capture overwash sediments during episodic events. The marsh would complement the existing marsh on the east end of the island.
4. Protect the beach nourishment and shoreline stabilization restoration efforts by constructing a rock revetment feature along Barataria Pass and Barataria Bay.

The alternative includes the restoration area on West Grand Terre Island, a borrow area in the Gulf of Mexico southeast of the island in state waters, an overburden disposal area, and conveyance corridors connecting the borrow area to the island and to the overburden disposal area (see Figure 3.2-1).

The alternative would create or restore approximately 195 acres of beach and dune habitat, create or restore approximately 160 acres of intertidal marsh habitat, and protect 8,500 linear feet of shoreline along Barataria Pass and Barataria Bay on the west side of West Grand Terre Island. In addition, an extension of the beach and dune habitat along the Gulf-front shoreline to the east end of the island would consist of approximately 56 acres spanning 5,600 feet of shoreline. The total length of protected shoreline resulting from the alternative would be approximately 14,100 feet.

GULF BEACH-DUNE FILL

The Gulf beach-dune fill area consists of a dune feature with a crown width of 290 feet and a target elevation of +8.0 feet North American Vertical Datum of 1988 (NAVD88), from Stations 60+00 to 145+00. The dune side slopes are projected at a 1 vertical (V) to 30 horizontal (H) degree gradient extending downward from the dune crown on the Gulf side to the beach platform and on the north side to grade forming the dune-marsh interface. The beach platform of the Gulf beach-dune fill area resides on the Gulf side of the dune and is 65 feet wide with a target elevation of +6.0 feet NAVD88. The beach slope is projected seaward at a 1V:40H gradient extending to the seafloor. The east beach fill area consists of a beach platform with a crown width of 230 feet and a target elevation of +8.0 feet NAVD88, from Stations 4+00 to 60+00. The east beach fill side slopes are consistent with that of the dune feature at 1V:30H, which includes, based on the preliminary results of the geotechnical analysis, settlement of a +1.5-foot tolerance.

The dune platform would be planted immediately following construction. The vegetative plantings would include a mixture of some or all of the following herbaceous species: bitter panicgrass (*Panicum amarum* var. *amarum* ‘Fourchon’), seashore paspalum (*Paspalum vaginatum* ‘Brazoria’), seacoast bluestem (*Schizachyrium maritimum* ‘Timbalier’), seashore dropseed (*Sporobolus virginicus*), sea oats (*Uniola paniculata* ‘Caminada’), saltmeadow-marshhay cordgrass (*Spartina patens* ‘Gulf Coast’), and Gulf cordgrass (*Spartina spartinae*). Woody species would be planted landward of the restored dune and supratidal back berm area, at a planting density of 15% to mimic the sparsely vegetated native vegetative assembly that typically occurs in this area. Woody species for the dune and supratidal areas would primarily be matrimony vine (*Lycium barbarum*).

BACK-BARRIER MARSH

The marsh fill area extends along the western half of the island, north of the Gulf beach-dune fill area, from Stations 80+00 to 150+00. The marsh fill area is approximately 7,000 feet long and ranges from 485 to 1,300 feet wide. The target elevation of the marsh fill area is +2.0 feet NAVD88. After construction and consolidation, the newly created marsh platform would be planted with smooth cordgrass (*Spartina alterniflora* var. ‘Vermilion’) and other appropriate species.

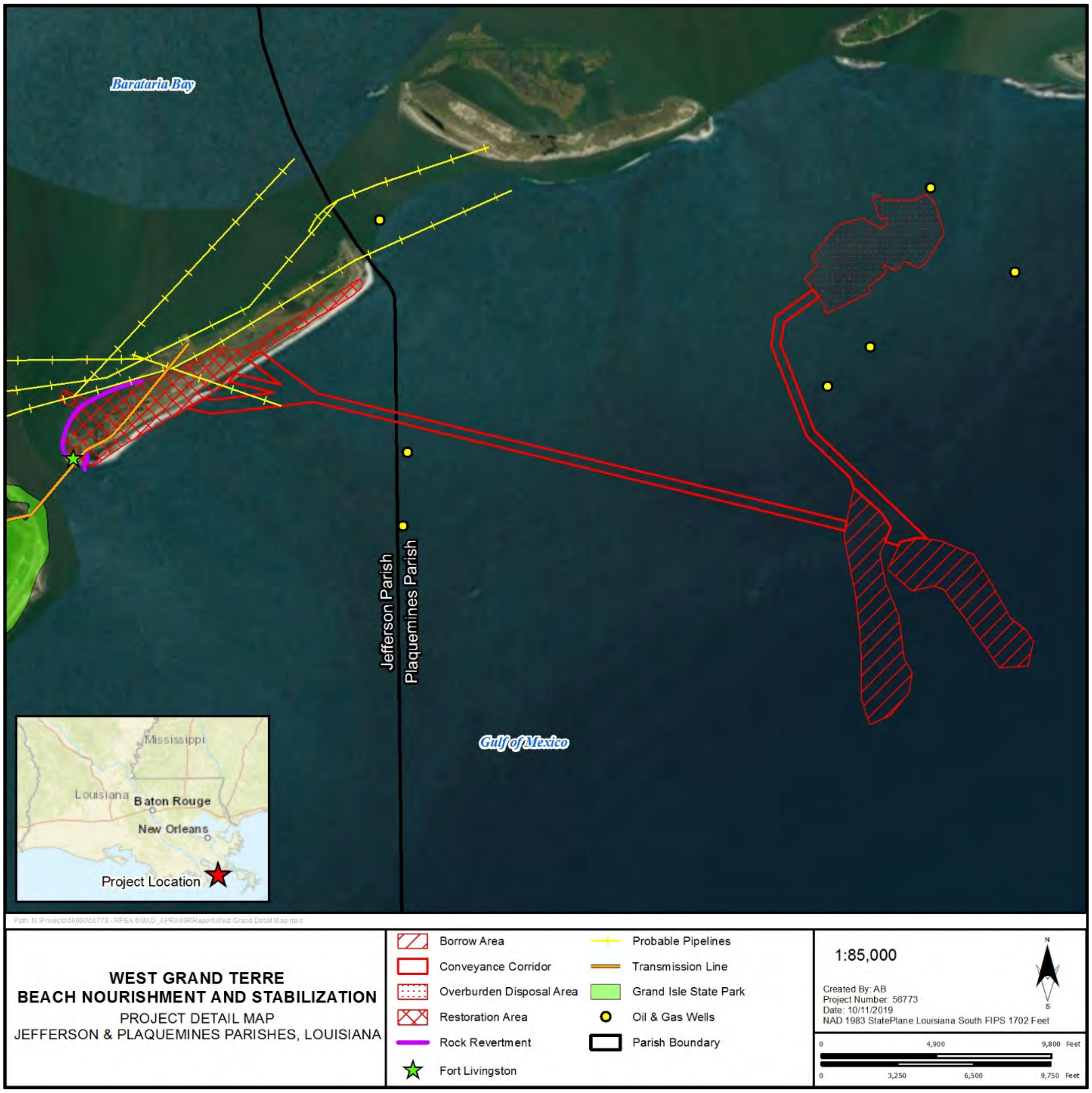

Figure 3.2-1. Location of the West Grand Terre Beach Nourishment and Stabilization alternative.

ROCK REVETMENT

The rock revetment feature along Barataria Pass would begin at the northwest end of the Fort Livingston breakwater and continue around the bayside of the island along the 2-foot contour where it would tie into the edge of the Chevron Pipeline Canal. The rock revetment would be designed in three segments:

1. Segment A would extend approximately 1,200 feet from the existing northwest end of the Fort Livingston breakwater around the marsh fill area and would terminate midway along the revetment alignment to the LDWF access channel. Typical features on this segment include an elevation of +6.5 feet NAVD88 and bench to elevation +3.0 feet NAVD88.

2. Segment B would extend approximately 1,370 feet around the marsh fill area from the end of Segment A ending at the LDWF access channel.
3. Segment C would extend the remaining distance around the marsh fill area of approximately 2,590 feet from the LDWF access channel and would tie into an existing marsh area south of the Chevron Pipeline Canal.

Both Segments B and C would include a crest width of 10 feet with Segment B at an elevation of +4.5 feet NACD88 and Segment C at an elevation of +2.5 feet NAVD88. The bayside slopes would be set equal to 1V:3H, and marsh side slopes would be set equal to 1V:2H for Segments B and C, respectively. All three segments would be underlain by a geotextile fabric and include core stone and armor stone layers.

A 540-foot segment of the Gulf-side rocks surrounding Fort Livingston would be restored and extended north to the current shoreline. Furthermore, a 180-foot rock revetment spur would extend southeast from the current Fort Livingston rock alignment to capture sand transported by longshore currents. The spur would be sited along the historical shoreline alignments.

BORROW AREA

The borrow area would be approximately 4.6 nautical miles (NM) east-southeast of the center of West Grand Terre Island in state waters. Based on extensive geophysical, geotechnical, hazards, and archaeological studies, potential oil and gas infrastructure were avoided in the layout of the borrow area. Seafloor elevations in the borrow area range from -28 feet NAVD88 to -34 feet NAVD88.

The borrow area would be subdivided into two subsections, Borrow Area West and Borrow Area East. In general, subsections are approximately rectangular in form. The stratigraphy for the borrow area subsections is generally characterized by two layers, an overburden layer comprising silts, clays, and fine sand and a sand layer comprising fine sand with silt and clay lenses.

The overburden layer thicknesses would range from 10 to 18 feet. A 50-foot bench was included between the bottom of cut for the overburden layer and top of cut for the sand layer to account for slope adjustment between sediment layers. The sand layer thicknesses would range from 10 to 30 feet. Cut depths would range from -56.0 feet to -70.0 feet NAVD88. The overburden would be disposed of in the previously excavated borrow areas S1 and D1 of the Chenier Ronquille Barrier Shoreline Restoration project (BA-76).

The borrow area subsections were designed based on suitable sediment availability and efficient dredge cut patterns derived from the detailed design-level geophysical and geotechnical surveys. Estimates of the average percent sand and grain size computed from vibracores taken within the subsections equaled 91% and 0.16 millimeters (mm), respectively. The estimated available volumes of suitable restoration sediment and overburden are 4.0 million cubic yards (MCY), and 2.9 MCY, respectively.

CONVEYANCE CORRIDORS

Two conveyance corridors have been designed for the alternative (see Figure 3.2-1). One conveyance corridor connects the two borrow area subsections and extends to the island to transport sediment to the restoration area. The overburden disposal conveyance corridor connects the borrow area subsections to the overburden disposal area. The south end of the overburden disposal conveyance corridor bifurcates to connect the Borrow Area West and Borrow Area East subsections.

The conveyance corridor between the borrow areas and the island was sited based on a review of the NOAA Nautical Chart No. 11358 (NOAA 2014), and historical pipeline/infrastructure databases. The alignment of the conveyance corridor originates in the borrow areas and progresses northwest to the restoration area for approximately 5.1 NM. The conveyance corridor would be 400 feet wide with a 200-foot allowable anchor area on each side. Water depths along the alignment vary from approximately -31 feet NAVD88 to 0 feet NAVD88 at the Island. A review of the data indicated that the alignment would not cross any oil and gas pipelines from the borrow areas to the alternative.

Similarly, the alignment of the overburden disposal conveyance corridor originates at the borrow area subsections, progresses north-northwest through the prior Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35) borrow area, then turns north and enters the prior East Grand Terre Island Restoration (BA-30) and Chenier Ronquille Barrier Shoreline Restoration (BA-76) borrow areas. The overburden disposal conveyance corridor would be 400 feet wide with a 200-foot allowable anchor area on each side and would be approximately 2.4 NM long. Water depths along the alignment vary from approximately -31 feet NAVD88 to approximately -10 feet NAVD88. A review of the data indicated that the alignment would not cross any oil and gas pipelines from the borrow area subsections to the overburden disposal area.

Current and Historical Conditions

West Grand Terre Island, like all other coastal barrier islands in Louisiana, is low lying and comprises three primary physical features: the beach, dune, and back-barrier marsh. These coastal barrier islands are an integral part of the state's biologically productive and economically valuable coastline. The purpose of the alternative is to restore West Grand Terre Island's geomorphic form and ecological function and to provide a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on the interior estuary and wetlands. The alternative would also enhance protection of Fort Livingston.

The alternative is needed because for more than a century, West Grand Terre Island has experienced persistent degradation and erosion. As detailed in the preliminary design report (Coastal Engineering Consultants, Inc. [CEC] 2018a), the overall shoreline change rate (1884–2016) was -6.6 feet per year, with the near-term rate of shoreline change between 1996 and 2016 estimated at -13.4 feet per year (CEC 2018a). This includes three U.S. Army Corps of Engineers (USACE) dredge disposal projects between 1996 and 2016 in which material dredged from maintenance dredging of the Barataria Waterway was placed along the West Grand Terre Island beach shoreline (USACE n.d.). The largest of these maintenance projects included placing 688,000 cubic yards of material along the shore (CEC 2018a). It is also worth noting that the Final PDARP/PEIS identifies coastal wetland oiling as a contributing factor for increased coastal wetland erosion because of the loss in vegetative cover along the nearshore environment (DWH Trustees 2016: 4-327).

Restored Coastal Habitats

The objectives of the alternative are to restore and enhance dune and back-barrier marsh habitat. Barrier islands in Louisiana are typically low lying and comprise three primary physical features: the beach, dune, and back-barrier marsh. Barrier islands act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands. To restore their geomorphic form and ecological function and to provide this buffer involve 1) reinforcing the shoreline through beach and dune restoration, and 2) providing a marsh platform to capture overwash sediments during episodic events (i.e., sediment that would otherwise be carried into the back-bay areas to form shoals or be lost into deeper waters). The marsh would also serve as a rollover platform as the island migrates landward. Restoration of the geomorphic form and ecological function includes vegetating both the restored dunes and back-barrier marsh platforms with native plants to 1) provide wetland habitat for a diverse number of plant and animal species and 2) help retain sediment on the island.

Construction Methodology and Schedule

Construction methods for the alternative would involve using a hydraulic cutterhead dredge at the borrow area to loosen sand and transport the sand slurry to the restoration area using booster pumps and a submerged sediment pipeline. Once the sand slurry reaches the restoration area, a shore-based construction crew would shape and grade the sediment using bulldozers and similar equipment in the Gulf beach-dune fill area, the back-barrier marsh area, and for the placement of rock revetment segments. The overburden that is dredged from the borrow area would be conveyed via a submerged pipeline to the overburden disposal area.

Installation and operation of the submerged sediment pipeline would require cranes, barges, welding machines, and air compressors. Other construction machinery would include work boats and crew boats, quarters barge generators, and miscellaneous vehicles.

Access channels would be excavated using barge-mounted bucket excavators and associated crews. Separation and marsh containment dikes would be constructed using a marsh buggy and associated operator.

Following fill placement, sand fencing and vegetative plantings would be installed. The sand fences are porous barriers that reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Following construction, vegetative plantings would commence for the dune and supratidal platform followed a year later by the marsh vegetative plantings. Sand fencing and vegetative planting unit costs were derived from review of recent construction contract bids.

The total estimated construction time for the alternative is 16 months. Project scheduling assumes dredging would be continuous, i.e., 24 hours per day and 7 days per week (CEC 2019).

Monitoring Requirements

Monitoring of the alternative for achievement of applicable performance criteria is described in the alternative’s attached MAM plan (see Appendix D).

3.2.1.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

The West Grand Terre alternative has been 95% designed, and all E&D costs are covered from the RESTORE grant this alternative received. Construction and implementation of this alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication of June 7, 2019). A portion of the terrestrial alternative is on state-owned land and managed by LDWF to support marine research activities. The LDWF-owned land on the southwest portion of the island near Fort Livingston includes several buildings and structures that made up the Lyle St. Amant Marine Research Laboratory (hereinafter referred to as *LDWF lab*), which was closed in 2008 following Hurricane Gustav. The borrow area and offshore portions of the conveyance corridors are located within state waters. CPRA would obtain servitude agreements from the private landowners, and no payment would be made for acquiring these rights.

E&D, land rights, permitting, and early adaptive management (Phase 1) for the West Grand Terre alternative was funded with RESTORE Act monies. The total estimated cost for all remaining restoration implementation components of the alternative is $92,500,000 (NRDA funds) (Table 3.2-1). This includes construction, construction administration, construction supervision, inspection, operations and maintenance, post-construction monitoring, and contingencies. The estimated cost represents a very close approximation given the 95% design status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-1. Construction Cost Estimate for the West Grand Terre Beach Nourishment and Stabilization Alternative

Description	Cost
Construction	$85,600,000
Operations and maintenance	$5,800,000
MAM	$1,100,000
Total (NRDA funds)*	**$92,500,000**

***** Including contingency.

The cost to implement the alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The West Grand Terre alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes. Direct and indirect impacts from the oil spill also led to the injury and degradation of sandy beach and dune habitats along shorelines and barrier islands across the northern Gulf of Mexico, which were also impacted as a result of oil spill response activities. Coastal wetland oiling from the DWH Oil Spill is a contributing factor for increased coastal wetland erosion due to the loss in vegetative cover along the nearshore environment (DWH Trustees 2016: 4-327).

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the DWH Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is in the Barataria Basin, the coastal wetlands of which provide foundational habitat for the Barataria Basin ecosystem, support resources within the Barataria Basin and throughout the Gulf of Mexico, and were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through beach, dune, and intertidal marsh habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat; accelerate recovery of injured ecosystem functions; and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating or restoring approximately 251 acres of beach and dune habitat and approximately 160 acres of intertidal marsh habitat and protecting and stabilization of approximately 14,100 linear feet of shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The DWH Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- East Grand Terre project (BA-30; 2010; Plaquemines Parish) in which appropriately 621 acres of land was created by restoring 2.8 miles of barrier shoreline through construction of a 6-foot-high dune, 165 acres of beach habitat, and 456 acres of marsh platform using sand and mixed sediment from two offshore borrow areas (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).
- Caminada Headland Beach and Dune Restoration (BA-45; 2013–2015; Lafourche Parish), which restored and maintained headland through the creation of dunes and beach habitat. The project placed 3.3 MCY of sand from the South Pelto Blocks 12 and 13 borrow area to restore approximately 6 miles of shoreline by constructing a 7-foot-high and approximately 290-foot-wide dune and a 4.5-foot-high and 65-foot-wide beach over a surface area of approximately 303 acres (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).
- Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35; 2009; Plaquemines Parish), which consists of the following elements: approximately 350 acres of total fill area, including a marsh platform approximately 1,000 feet wide contiguous with the northern side of the gulf shoreline of Bay Joe Wise; a dune built to an elevation of 6 feet with a dune crest width of approximately 110 feet; approximately 3 MCY of sediment dredged from the Pas la Mer, Pass Chaland, and Grand Pass ebb delta; construction of approximately 10,000 feet of 4-foot-wide, 2-foot-deep water exchange channels to enhance surface hydrology; and immediate post-construction aerial seeding for plant cover (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).

This documented experience and the successful completion of previous marsh creation with shoreline and beach and dune enhancement projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can begin construction within the timeframe indicated in the NOS (12–18 months from NOS publication of June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. The alternative is estimated to protect approximately 50% of the West Grand Terre Island over the next 20 years (CEC 2018a).

Prevention of Future Injury and Avoid Collateral Injury

Marsh creation projects help prevent future injuries to marsh vegetation and soils, as well as to estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The shoreline protection that would be provided by the West Grand Terre alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of surrounding marsh. Further, beach and dune creation and enhancement can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review is described in Section 4.2 and indicates that adverse effects from the alternative (turbidity, noise and other disturbances in the water column, habitat disturbance [including SAV and benthic habitat], EFH effects, behavioral changes to wildlife or protected species such as Gulf sturgeon [*Acipenser oxyrinchus desotoi*] and sea turtles, etc.) would largely be minor, localized, and short term. Potential long-term adverse effects would be limited to disturbances to unknown cultural resources from construction activities. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of marsh, beach, and dune habitats with shoreline protection restores important linkages among and between wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the West Grand Terre alternative includes creating or restoring approximately 251 acres of beach and dune habitat and approximately 160 acres of intertidal marsh habitat and protecting and stabilization of approximately 14,100 linear feet of shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

This West Grand Terre alternative would not affect public health and safety. Creation of marsh habitats with shoreline protection and beach and dune creation included in the alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.1.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the West Grand Terre alternative. The OPA analysis indicates that the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because its implementation would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and other such measures to avoid or minimize adverse impacts would be implemented in the design and implementation of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.2 Golden Triangle Marsh Creation Alternative

3.2.2.1 ALTERNATIVE DESCRIPTION

Overview

The Golden Triangle Marsh Creation alternative (hereinafter the *alternative* or the *Golden Triangle alternative*) is in the eastern portion of the Golden Triangle Marsh and is adjacent to New Orleans, Louisiana, and the surrounding communities in Orleans Parish and St. Bernard Parish (Figure 3.2-2). The Golden Triangle Marsh, which is a narrow band of brackish marsh, is directly east of New Orleans between Lake Borgne and the confluence of the Mississippi River Gulf Outlet (MRGO) and the Gulf Intracoastal Waterway (GIWW). The northern portion of the marsh falls within the Bayou Sauvage National Wildlife Refuge (NWR), which is one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018).

The goals of the alternative are as follows:

1. Restore approximately 800 acres of brackish marsh.
2. Restore and protect wetland, fish, and wildlife habitats.
3. Restore degraded marsh and reduce wave/wake erosion.
4. Maintain landscape integrity and enhance community resilience.
5. Promote natural resource stewardship and environmental education and outreach.

The alternative includes the restoration area in the Golden Triangle Marsh; a borrow area east of the marsh in Lake Borgne; a dredged sediment pipeline corridor connecting the borrow area to the restoration site; and an access corridor from Chef Menteur Pass, northeast of the marsh, to the borrow area (see Figure 3.2-2).

The alternative would create or restore approximately 774 acres of broken marsh and open water, which comprises the restoration of 694 acres of degraded marsh and nourishment of 80 acres of marsh, through the construction of approximately 44,000 linear feet of containment dikes. This marsh restoration would provide 494 acres of intertidal habitat and 263 acres of subtidal habitat. The alternative would help buffer the surge barrier, which would increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne.

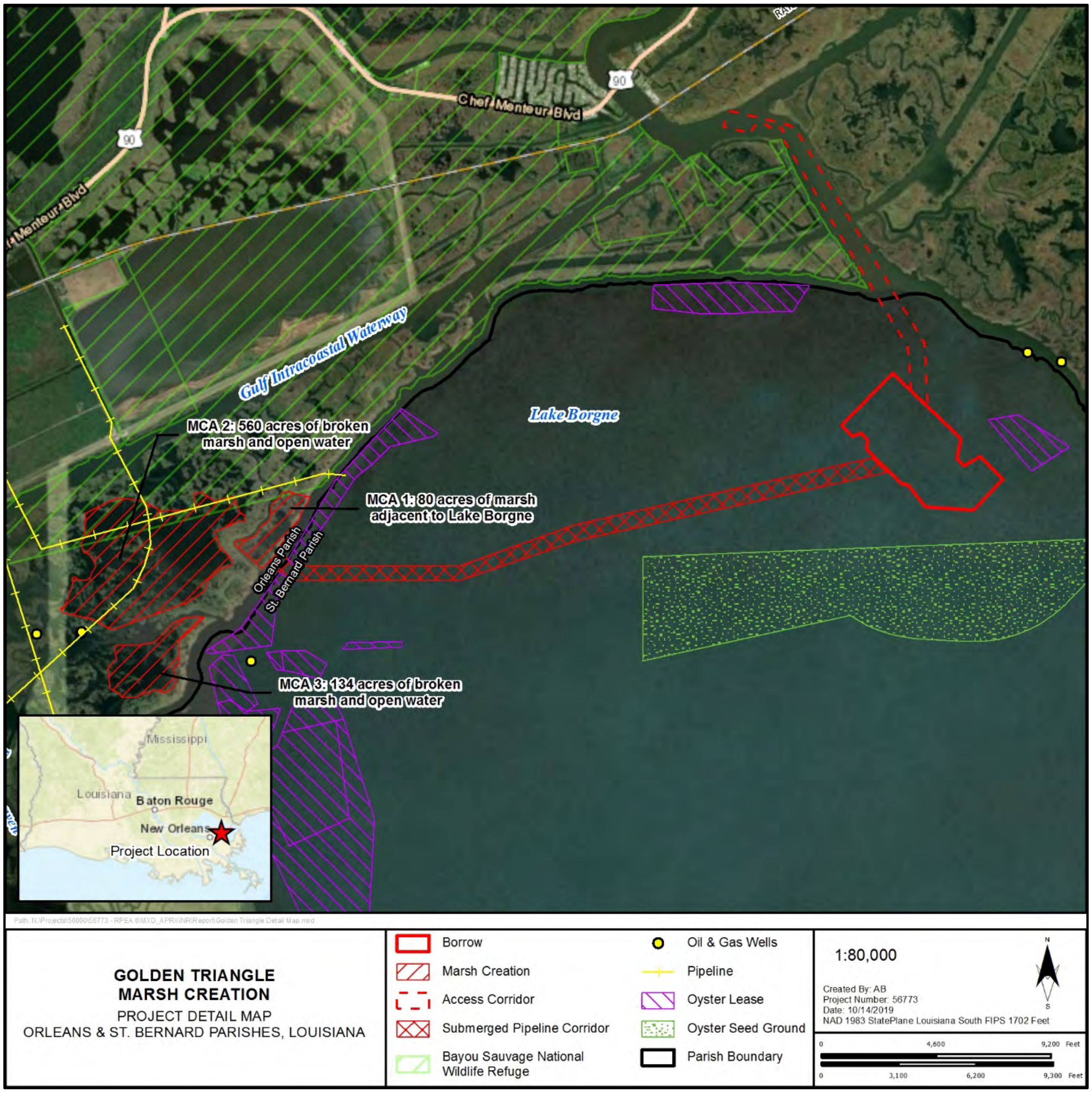

Figure 3.2-2. Location of the Golden Triangle Marsh Creation alternative.

MARSH CREATION AREAS

Three marsh creation areas (MCAs) are proposed under the Golden Triangle alternative:

- MCA 1: 80 acres of broken marsh and open water
- MCA 2: 560 acres of broken marsh and open water
- MCA 3: 134 acres of marsh adjacent to Lake Borgne

Each of the MCAs would be constructed to an elevation of +2.5 feet NAVD88 with material pumped from the borrow area in Lake Borgne to maximize the time that the marsh elevation is in the intertidal range (where *intertidal* is referring to the water level between local mean high water and mean low water elevations). An estimated 6,700,000 cubic yards of marsh compatible sediments would be required to meet the elevation goals in the three MCAs. The total marsh fill footprint is approximately 774 acres.

Approximately 44,930 linear feet of earthen containment dikes would be constructed along the perimeter of the MCAs to contain the marsh fill material. These dikes would be constructed using in-situ material excavated within the boundaries of the fill area so that the excavated area is refilled during construction.

Following fill and dike construction activities, the earthen containment dikes would be gapped after the fill material has settled to allow for the restoration of natural tidal exchange. Vegetation would be planted throughout the MCAs and along containment dike slopes to support marsh restoration. These vegetation plantings would consist of saltmeadow-marshhay cordgrass and common brackish marsh species found in the area.

BORROW AREA

Marsh fill material used to construct the MCAs would be dredged hydraulically from a 78-acre borrow area approximately 5.3 miles east-northeast of the alternative within Lake Borgne. The borrow area contains a mixture of soft to very soft clays, with fine sand and/or silts, which is compatible material for marsh creation. The borrow area design consists of one dredge cut to -24.0 feet NAVD88, with approximately 10,000,000 cubic yards of available marsh compatible fill material. Approximately 6,700,000 cubic yards of marsh compatible sediments from Lake Borgne would be dredged to fill the three MCAs.

One booster pump would be installed within the pipeline corridor to facilitate efficient hydraulic dredging and placement of marsh fill. A maximum area of 200 × 50 feet would be excavated to a maximum elevation of -10.0 feet NAV88 to accommodate the booster pump. All excavated material would be sidecast into the temporary sidecast disposal area designated within the pipeline corridor and graded to within 0.5 foot of pre-construction elevation upon demobilization.

PIPELINE CORRIDOR

A 361-acre pipeline corridor would be used to transport fill from the borrow area to the restoration site through a submerged pipeline. The pipeline corridor would run from east to west from the borrow area to MCA 2. The pipeline corridor would pass through a 500-foot-wide area adjacent to the northwest shoreline of Lake Borgne that had been previously cleared of oyster leases (APTIM 2018a). The pipeline corridor would be 100 feet wide. A booster pump would be installed in a dredged area within the conveyance corridor.

The average pipeline distance would be 31,933 linear feet, with the longest pumping distance being from the borrow area to the central fill area (32,600 linear feet). All dredge pipe/subline installed within the corridor would be submerged, and navigation lights would be affixed to buoys every 500 feet, or per U.S. Coast Guard (USCG) regulations, to notify marine traffic of the submerged pipeline. Bathymetry within Lake Borgne varies from approximately -6.0 feet NAVD88 to -12.0 feet NAVD88. It is assumed that these depths would be sufficient for floating equipment to install the subline.

ACCESS CORRIDOR

A 210-acre access corridor from Chef Menteur Pass into Lake Borgne would be designated as the dredge access corridor to the Golden Triangle borrow area. Equipment would enter the access area via the GIWW and into Lake Borgne via the Pass. Bathymetric surveys show that this access corridor may allow for navigation of equipment to access the borrow area without the need for access dredging.

Current and Historical Conditions

The New Orleans region has experienced substantive modification over the last 300 years of human occupation along the Mississippi River. The Golden Triangle alternative is near the confluence of two major navigation and shipping channels: the MRGO and the GIWW. The construction of these projects has significantly altered the hydrology of the region, resulting in accelerated land loss rates, including wetlands and habitats, and increased susceptibility to severe weather events (USACE 2012). The MRGO channel alone has contributed to an estimated 19,400 acres of wetlands conversions and 4,750 acres of shallow open water converted to deep water or dredge material banks (USACE 1999, 2012).

The MRGO was deauthorized in 2008 following severe shoaling in the MRGO channel from Hurricane Katrina in August 2005. In 2008, the USACE constructed the Inner Harbor Navigation Canal (IHNC) Lake Borgne Surge Barrier at the confluence of the GIWW and the MRGO, which is located approximately 12 miles east of downtown New Orleans. A rock closure structure was also constructed across the MRGO near the Bayou La Loutre Ridge in St. Bernard Parish, Louisiana, in 2009 (USACE 2012). However, levee and revetment construction, dredging activities, and pipeline construction efforts continue to alter the natural environment in the Golden Triangle area. High rates of land loss in the area can also be attributed to natural subsidence as well as accelerated subsidence due to oil and gas exploration and saltwater intrusion.

The concept of the Golden Triangle alternative was introduced in the 2012 coastal master plan (CPRA 2012) to mitigate the effects of saltwater intrusion and land degradation the area has experienced. The alternative is bounded to the southeast by Lake Borgne, to the southwest by Bayou Bienvenue, to the north by the GIWW, and to the west by the IHNC. A series of pipeline canals and interconnected bayous run throughout the Golden Triangle marsh.

Restored Coastal Habitats

The objectives of the proposed Golden Triangle alternative are to restore degraded brackish marsh. These marshes act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands, thereby helping restore and protect wetland, fish, and wildlife habitats. The alternative would help buffer the surge barrier, which would increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne. As a result, the alternative would help maintain landscape integrity, enhance community resilience, and promote natural resource stewardship and environmental education and outreach.

Construction Methodology and Schedule

Construction methods for the Golden Triangle alternative would involve use of a hydraulic cutterhead suction dredge to excavate marsh fill material in the borrow area. A booster pump would be installed if needed to help pump material to the fill sites. Marsh buggies would be used to construct earthen dikes. A staging area would be located near the shoreline of Lake Borgne between the three MCAs and along the pipeline corridor.

The earthen dike fill source would be excavated from the area adjacent to the earthen dike, within the MCAs. The earthen containment dikes would be constructed to a crest elevation of +4.0 feet NAVD88 with a minimum crest width of 5 feet. In areas where the dike crosses portions of existing marsh, the dike would be built on top of the existing marsh platform. Additional training dikes may be constructed within the marsh footprint to control the fill at the discretion of the construction contractor. Dewatering would occur in up to six locations around the MCAs within the containment dike boundary to allow excess water to drain from the fill areas.

Marsh fill material would be pumped hydraulically to the alternative site area via a submerged pipeline. The submerged pipeline would be transported to the site on pontoons in approximately 500-foot sections. Once in the alternative site, the various sections of submerged pipeline would be joined together using ball joints into lengths of up to 2,500 feet and then sank into position within the pipeline corridor. A floating pipeline would be attached to the submerged pipeline at the borrow area end while the opposite end of the submerged line is managed ashore. Once the submerged line is in place, the dredge would be connected to the floating line and would traverse the borrow area to mine sediments. Shore pipe would be added as needed to advance the end of the discharge pipe as the MCAs are filled, and flexible HDPE pipe is typically used to distribute the marsh fill material due to self-weight and maneuverability. Marsh buggies would be used to move the end of the discharge to uniformly fill the marsh area. The construction contractor may opt to construct secondary dikes within the marsh platform to assist with controlling the placement of the material.

The total estimated construction time is approximately 14 to 15 months, and this schedule assumes the following:

- A 60-day period for mobilization and pre-construction surveys.
- A production rate of 300 linear feet/day per marsh buggy for construction of the containment dikes and 1-week closure periods for the containment dikes in MCAs 1 and 3, resulting in approximately 123 days to create MCAs 1–3. This may be decreased to 93 days if the construction contractor begins dredging prior to the completion of construction of the containment dike.
- A marsh fill production rate of 70,000 cubic yards/day, resulting in a total of 142 days to complete marsh fill activities.
- A 70-day demobilization period that includes a 30-day waiting period to begin final marsh platform elevation surveys.
- 60 days of flexibility to account for weather and other uncontrollable events.

Following 1 or 2 years after construction of containment dikes and fill of MCAs, vegetation would be planted within the MCAs and remaining containment dikes. This schedule provides time for the marsh material to consolidate to facilitate accessibility and for natural vegetation to take hold.

Monitoring Requirements

Monitoring of the Golden Triangle alternative is described in the attached MAM plan (see Appendix D).

3.2.2.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

The alternative is 95% designed, and all E&D costs are covered from the RESTORE grant this alternative received. Construction and implementation of this alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). All portions of the alternative are within

Lake Borgne and shore-fringing marsh areas. Some of the land within the boundaries of the alternative is privately owned, and coordination with private landowners is underway (APTIM 2018a). No new rights-of-way or in-fee land acquisitions would be required.

E&D, land rights, permitting, and early adaptive management (Phase 1) for the Golden Triangle alternative was funded with RESTORE Act monies. The total estimated cost for all remaining restoration components of the Golden Triangle alternative is $50,000,000 (NRDA funds) (Table 3.2-2). This includes construction, construction administration, construction supervision, inspection, post-construction monitoring, and contingencies. The estimated cost represents a very close approximation given the 95% design status and is comparable with the costs of similar projects of this size and scope.

Table 3.2-2. Construction Cost Estimate for the Golden Triangle Marsh Creation Alternative

Description	Cost
Construction	$47,000,000
Operations and maintenance	$2,000,000
MAM	$1,000,000
Total (NRDA funds)*	**$50,000,000**

***** Including contingency.

The cost to implement the Golden Triangle alternative is reasonable, appropriate, and comparable to other equivalent restoration projects. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Golden Triangle alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Pontchartrain Basin, within which the coastal wetlands provide foundational habitat for the Pontchartrain Basin ecosystem, support resources within the Pontchartrain Basin, and are interconnected with other resources throughout the Gulf of Mexico that were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through intertidal and subtidal marsh habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat, accelerate recovery of injured ecosystem functions, and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Golden Triangle alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating or restoring approximately 694 acres of degraded marsh and nourishment of 80 acres of marsh, thereby providing 494 acres of intertidal habitat and 263 acres of subtidal habitat. The benefits from the Golden Triangle alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- Lake Hermitage Marsh Creation – NRDA Early Restoration Project (BA-42; 2015; Plaquemines Parish), which created approximately 104 acres of brackish marsh (Deepwater Horizon Restoration Project Report 2018).
- Grand Liard Marsh and Ridge Restoration (BA-68; 2014–2015; Plaquemines Parish), which created and nourished 450 acres of marsh and restored 15,484 linear feet of ridge on the east bank of Bayou Grand Liard (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2019).
- Oyster Bayou Marsh Restoration (CS-59; 2017; Cameron Parish), which encompasses four MCAs totaling 740 acres using sediment dredged approximately 3.2 miles offshore and transported via pipeline to the project site. In addition to the MCAs, twenty 450-foot-long terraces are being constructed in the northeast section of the project to further reduce wave erosion. Tidal creeks and ponds were also constructed prior to placement of dredged material within the MCAs to facilitate formation of these features post-construction (CPRA 2017b).

This documented experience and the successful completion of previous marsh creation projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. It is estimated that the alternative will have a 20-year design life (APTIM 2018a).

Prevention of Future Injury and Avoid Collateral Injury

Marsh creation projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The marsh areas that would be provided by the Golden Triangle alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of the marsh and surrounding wetlands. Further, marsh creation and enhancement can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review is described in Section 4.3 and indicates that adverse effects from the alternative (turbidity, noise and other disturbances in the water column, habitat disturbance [including SAV and benthic habitats], EFH effects, behavioral changes to wildlife or protected species such as Gulf sturgeon or their critical habitat and West Indian manatee [*Trichechus manatus*], etc.) would largely be minor, localized, and often short term. Potential long-term adverse effects would be limited to disturbances to unknown cultural resources from construction activities. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. Because the alternative is within Gulf sturgeon designated critical habitat, consultation under Section 7 of the Endangered Species Act of 1973 (ESA) with the NMFS and USFWS is ongoing. Through this consultation, any additional measures or terms and conditions necessary to avoid adverse modification of Gulf sturgeon critical habitat will be identified and incorporated into the alternative. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of marsh habitats with marsh protection restores important linkages among wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the Golden Triangle alternative includes creating or restoring approximately 694 acres of degraded marsh and nourishment of 80 acres of marsh, thereby providing 494 acres of intertidal habitat and 263 acres of subtidal habitat. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

The Golden Triangle alternative would not affect public health and safety. Creation of marsh habitats with marsh protection included in the alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.2.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Golden Triangle alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design and implementation of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.3 Biloxi Marsh Living Shoreline Alternative

3.2.3.1 ALTERNATIVE DESCRIPTION

Overview

The Biloxi Marsh Living Shoreline alternative (hereinafter the *alternative* or the *Biloxi Marsh alternative*) is in southeast St. Bernard Parish, Louisiana, along the shoreline of Bayou La Loutre (Figure 3.2-3). The alternative extends from Eloi Bay to Morgan Harbor on the north side of the peninsula and is open to the Chandeleur and Breton Sound. The area is characterized by low marshes with an erosional shoreline.

The purpose of the alternative is to create bioengineered, marsh-fringing oyster reefs to promote the formation of self-sustaining living shoreline protection structures. The goal of the alternative is to install 9 to 11 miles (and no more than 12.5 miles) of oyster barrier reef along the eastern shoreline of the Biloxi Marsh, which would provide oyster habitat, reduce wave erosion, and prevent further marsh degradation.

The goals of the alternative are as follows:

1. Provide shoreline protection by using living shoreline products to attenuate wave energy.
2. Stimulate oyster growth in the immediate area.

Eastern oysters (*Crassostrea virginica*) are vital to Louisiana's coastal ecosystems because they provide aquatic habitat as well as filter large volumes of water during feeding. In general, physical environmental needs for oyster growth include appropriate salinity, tidal influence, and hydrographic circulation, which allow oyster larvae to remain near an existing reefs but with enough exchange to maintain good food supply and near-neutral silt balance on the oyster reef/beds (NOAA Fisheries Eastern Oyster Biological Review Team 2007). With these elements in place, oysters need only a hard surface on which to attach.

The Biloxi Marsh alternative is a coastal restoration project designed to create bioengineered, marsh-fringing oyster reefs to promote the formation of self-sustaining living shoreline protection structures. Bioengineered oyster reefs would be created by placing a manufactured product or products off the shoreline to establish a living breakwater structure. Approximately 9 to 11 miles (and no more than 12.5 miles) of reef breakwaters and/or rock revetments would be constructed under the alternative. More information about the potential construction bidding process for the alternative is discussed below under Construction Methodology and Schedule section.

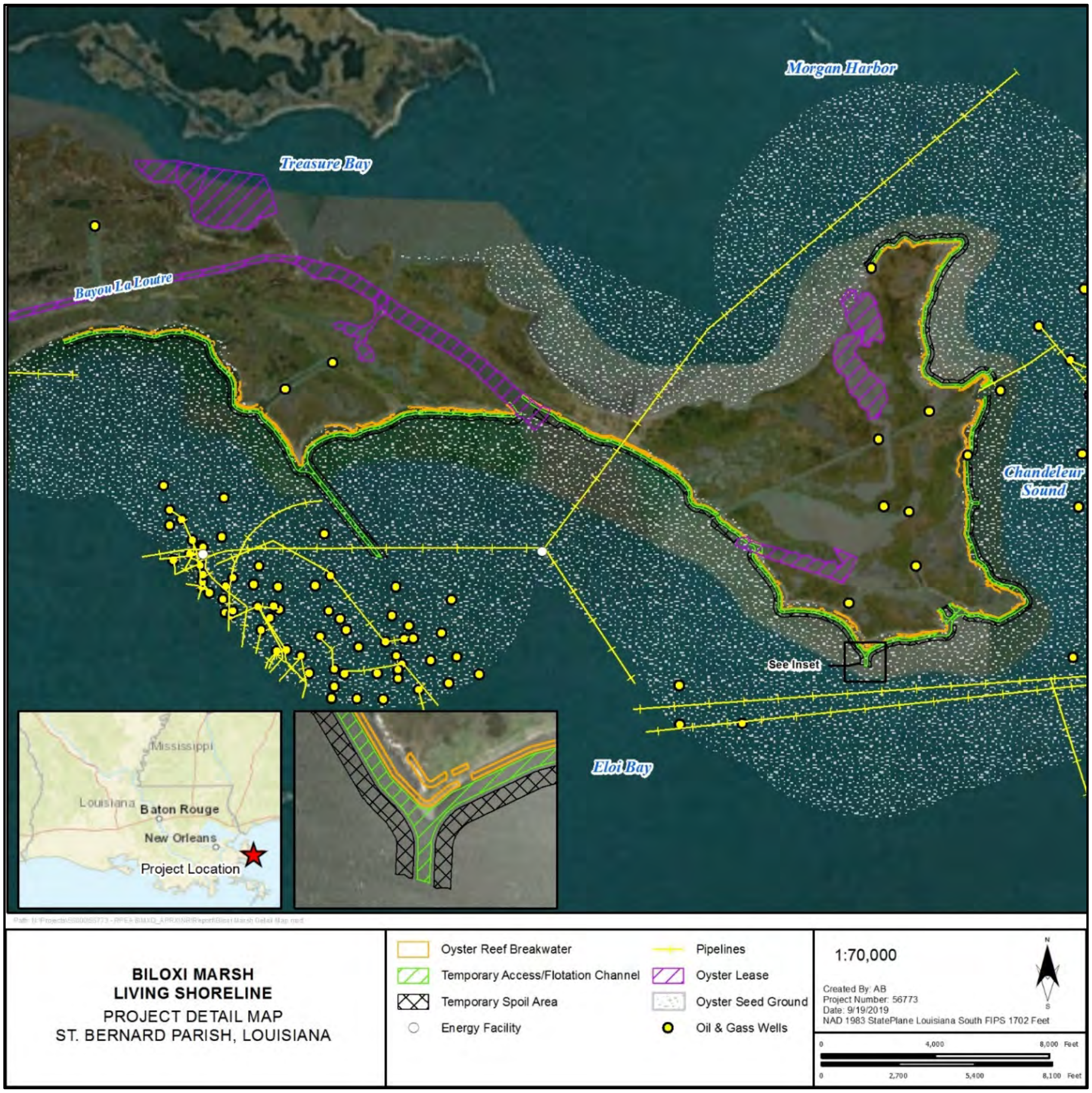

Figure 3.2-3. Location of the Biloxi Marsh Living Shoreline alternative.

Oyster reef breakwaters would be constructed from materials such as concrete, steel, mesh, geogrid, piles, rock, floating platforms, oyster shell, or similar materials. The oyster reef breakwater would be constructed on the edge (approximately 0–10 feet) off the existing shoreline. The oyster reef breakwater would range from 120 to 270 feet wide at the base of the breakwater. The height of the breakwater would be approximately 3 feet above mean sea level. USCG-approved Navigation Aids (NAVAIDS) would be permanently installed in key locations using pile driving. To facilitate construction of the breakwater, a temporary access channel may be dredged approximately 20 feet from the breakwater on the seaward side along the length of the alternative.

Based on modeling conducted for preliminary engineering analysis, the alternative is estimated to reduce land loss by more than 50% where the reef breakwater structures are placed. A preliminary performance goal of reducing the shoreline erosion rate by at least 50% has been established for the alternative (Mott MacDonald 2017), which would reduce the average shoreline erosion rate to -5.5 feet annually. Once met, the alternative would save approximately 6.0 to 7.3 acres per year over the up to 11 miles of breakwater structure constructed (Mott MacDonald 2017).

Current and Historical Conditions

The Biloxi Marsh consists of approximately 189 square miles (49,000 hectares) of brackish and salt marshes that have been greatly impacted by shoreline erosion from wind-driven waves, with shoreline retreat rates ranging from 1 to 4 meters (m) per year (CPRA 2014a).

These marshes represent an important storm buffer to the city of New Orleans and are also productive habitats for many fish and wildlife species, as evidenced by the approximately 56 square miles (14,400 hectares) incorporated into the Biloxi Wildlife Management Area (WMA). The water bottoms around the Biloxi Marsh contain extensive areas of a low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). Spawning oysters from these grounds and nearby oyster seed grounds and bioengineered oyster reef projects (e.g., The Nature Conservancy's Lake Fortuna and Eloi Bay reefs and CPRA's completed Living Shoreline Protection Demonstration project) should provide ample larvae to facilitate development of the Biloxi Marsh alternative. Once established, the alternative could enhance the productivity of local oyster stocks. This is particularly important considering the Biloxi Marsh area is less prone to Mississippi River flooding events that impact oyster grounds in nearby Breton Sound (Soniat et al. 2013). The Biloxi Marsh reefs, therefore, could supply recruits to expedite recovery of flood-damaged oyster grounds, as well as other nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole.

Restored Coastal Habitats

Approximately 9 to 11 miles of living shoreline structures would be installed along the alternative. These shoreline protection features would serve as an important first line of defense for coastal marshes, functioning to help sustain the lower Biloxi Marsh (an important landbridge separating the Gulf of Mexico from Lake Borgne) by helping to prevent and/or reduce the rate of erosion of the marshes and shorelines along the shores of Eloi Bay.

Construction Methodology and Schedule

CPRA has engaged in a pre-bid Request for Information process to help drive competition and achieve cost savings and cost effectiveness in the implementation of the alternative. In February 2019, CPRA issued a Request for Information to solicit information from artificial reef manufacturers to develop a list of approved equivalent product configurations for potential use in the construction of the Biloxi Marsh alternative. CPRA evaluated the information received through the Request for Information, supplemented the information with engineering analyses conducted by the CPRA project design team, and determined the applicability of each product for use at the alternative. The final list of approved equivalent products is currently under development by CPRA. All products listed on the final list of approved equivalent products must be able to be installed by a third-party construction contractor.

If the alternative is selected for NRDA funding by the LA TIG, CPRA would include the final list of approved equivalent products in the *For Bid* documents for public bidding by prospective construction contractors. The *For Bid* documents are anticipated to include design details within the plans and a comprehensive technical specification for each product or product configuration (as applicable). It is anticipated that the *For Bid* plans would delineate the alternative shoreline into discrete segments with multiple product configurations eligible for installation to maximize performance of the restoration alternative and adapt to the variation in site conditions. Ultimately, it would be the contractor's sole decision to select the product configuration he/she wishes to install from the eligible list for each delineated segment of Biloxi Marsh shoreline. Not all product configurations are anticipated to be included for each delineated segment. Inclusion on the final list of approved equivalent products and *For Bid* documents does not guarantee selection of a particular artificial reef project by the contractor. One construction contract is anticipated to be awarded. It should be noted that even if certain product are not selected as an approved equivalent product configuration for this alternative, this would not preclude those manufacturers from participating in other CPRA projects.

Construction methods for the Biloxi Marsh alternative would involve using an excavator, crane, or similar equipment to place oyster reef breakwaters along the shoreline. Where tree stumps are present within the placement area, the stumps would likely be removed/excavated individually, and the void would be backfilled with granular fill. Geotextile fabric would be installed prior to oyster reef breakwater placement. Oyster reef breakwaters would be constructed from materials such as concrete, steel, mesh, geogrid, piles, rock, floating platforms, oyster shell, or similar materials.

There is no upland access to the restoration area. Access would be obtained from a navigable waterway such as Breton Sound via the Mississippi River. To facilitate construction of the breakwater, a temporary access channel may be dredged approximately 20 feet from the oyster reef breakwater along the length of the alternative along the seaward side of the breakwater. The temporary access channel would be excavated using barge-mounted bucket excavators and associated crews. All excavated material would be placed into a designated location for temporary spoils, approximately 20 feet from the temporary access channel on the seaward side of the access channel. The temporary spoils would be backfilled into the temporary access channel at the completion of the alternative.

Marsh buggy and other track equipment would be limited to 18 feet wide and confined to the alternative footprint. All equipment would be mobilized and demobilized by barge. Fully loaded drafts of all vessels would not exceed 7 feet at the lowest point on all vessels. Other construction machinery would include work boats and crew boats, quarters barge generators, welding machines, and miscellaneous vehicles.

Oyster lease areas would be buffered by 150 feet to avoid impacts during construction. If unfeasible, oyster leases within the 150-foot buffer would be acquired and extinguished prior to construction. CPRA is the only entity with the authority to extinguish oyster leases. The oyster lease extinguishment process is discussed in greater detail in Section 4.4.3.6.

The total estimated construction duration is 25 months.

Monitoring Requirements

Monitoring of the Biloxi Marsh alternative is described in the attached MAM plan (see Appendix D).

3.2.3.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

Additional E&D is underway and is being funded entirely by the RESTORE Act grant this alternative received alternative. No additional E&D costs are needed for implementation of the alternative, and construction and implementation can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). All portions of the alternative are located within shore-fringing marsh areas in offshore state waters. No new rights-of-way or in-fee land acquisitions would be required. The alternative may include the construction of a marine mattress if it is determined that artificial reef breakwaters are not appropriate for some areas of high erosion or where additional shoreline protection is needed. The use of a marine mattress would require a land rights agreement with a private landowner. The artificial reef breakwaters would be placed offshore with permission of the Louisiana Office of State Lands.

E&D, land rights, due diligence, permitting activities, and early adaptive management (Phase 1) for the Biloxi Marsh alternative were funded with RESTORE Act monies. The total estimated cost for all restoration components of the Biloxi Marsh alternative is $66,600,000 (NRDA funds) (Table 3.2-3). This includes construction, construction administration, construction supervision, operations and maintenance, post-construction monitoring, contingencies monitoring, and contingencies. The estimated cost represents a close approximation given the current E&D status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-3. Construction Cost Estimate for the Biloxi Marsh Living Shoreline Alternative

Description	Cost
Construction	$54,300,000
Operation and maintenance	$10,300,000
MAM	$2,000,000
Total (NRDA funds)*	**$66,600,000**

* Including contingency.

The cost to implement the Biloxi Marsh alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Biloxi Marsh alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Pontchartrain Basin, within which the coastal wetlands provide foundational habitat for the Pontchartrain Basin ecosystem, support resources within the Pontchartrain Basin, and are interconnected with other resources throughout the Gulf of Mexico that were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through oyster reef habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat, accelerate recovery of injured ecosystem functions, and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Biloxi Marsh alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating 9 to 11 miles of marsh-fringing oyster barrier reef to provide protection as a self-sustaining living shoreline. The benefits from the Biloxi Marsh alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- Living Shoreline Demonstration Project (PO-148; 2017; St. Bernard Parish), which provides approximately 3 miles of reef breakwater structure along the shoreline of Eloi Point (Mott MacDonald 2017).
- Terrebonne Bay Shore Protection Demonstration (TE-0045; 2007; Terrebonne Parish) is a demonstration project to demonstrate the cost and effectiveness of alternative shore protection methods, including artificial oyster reefs. The project evaluates three fabricated structures placed along the shore for their effectiveness in abating shoreline erosion, and for their ability to develop and sustain an oyster reef. In this project, each protection measure was installed to provide wave protection (Melancon et al. 2013).

This documented experience and the successful completion of previous living shoreline projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. It is estimated that the alternative would have a 20-year design life (Mott MacDonald 2017).

Prevention of Future Injury and Avoid Collateral Injury

Living shoreline projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The marsh-fringing oyster reefs that would be provided by the Biloxi Marsh alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of the Biloxi Marsh and surrounding wetlands. Further, shoreline creation and enhancement can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review is described in Section 4.4 and indicates that adverse effects from the project (turbidity, noise and other disturbances in the water column, habitat disturbance [including SAV and benthic habitat], EFH effects, behavioral changes to wildlife or protected species such as Gulf Sturgeon and manatee, etc.) would largely be minor, localized, and often short term. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of oyster reef habitat and shoreline protection restore important linkages among wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the alternative includes creating 9 to 11 miles of marsh-fringing oyster barrier reef to provide protection as a self-sustaining living shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

The alternative would not affect public health and safety. Creation of oyster reefs included in this restoration alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.3.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Biloxi Marsh alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the Biloxi Marsh alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.4 Fifi Island Forested Ridge with Breakwater Alternative

3.2.4.1 ALTERNATIVE DESCRIPTION

Overview

The Fifi Island Forested Ridge with Breakwater alternative (hereinafter the *alternative* or the *Fifi Island alternative*) is in Jefferson Parish, Louisiana, along the southwestern shoreline of Fifi Island along Bayou Rigaud (Figure 3.2-4). The area is immediately adjacent to breakwaters constructed by the Grand Isle Independent Levee District in 2015.

Figure 3.2-4. Location of the Fifi Island Forested Ridge with Breakwater alternative.

The alternative would create habitat on Fifi Island and protect Grand Isle and the nearby barrier islands from storm surges and wave action through the construction of approximately 22 acres of forested ridge and approximately 1,200 linear feet of rock breakwater. An approximately 6,000-foot forested, coastal ridge would be constructed along the north bank of Bayou Rigaud behind existing rock breakwaters.

The goals of the alternative are as follows:

1. Restore habitats within the Barataria Basin.
2. Protect resources, habitat, and other nearby restoration efforts on Fifi Island and Grand Isle.

ROCK BREAKWATER

Approximately 1,200 linear feet of new rock breakwater would be constructed on the southwest end of the island to extend the existing breakwater system around the island. The new rock breakwater would generally match the size of the existing breakwater, with an approximate base width of 80 feet and height of 8 feet above mean sea level. Composite geosynthetic material would be placed as the foundation of the breakwater, with stone and rock used as the primary construction material for the breakwater. The toe of both slopes (front and back) would be armored with additional rock to provide scour protection and prevent erosion of the structure.

FORESTED RIDGE

The ridge would be constructed of approximately 92,000 cubic yards of sediment dredged for access to the site and supplemented from sediment from a local borrow area. The specific borrow area for the Fifi Island alternative has not been identified. Borrow areas that could be used for construction of the alternative are Bayou Rigaud, Barataria Waterway Bar Channel, and Barataria Waterway Bay, all of which have been subject to environmental review and approved for use as borrow areas (Averill 2019). One or more of these borrow areas would be used to construct the ridge. The sediment would be placed on the protected (or inland) side of the newly constructed and existing rock breakwater (described above). The ridge would be approximately 6,000 feet long, 160 feet wide at the base, and 5 feet above mean sea level. The base of the ridge is estimated to be approximately 5 feet below the water line, and the total height would be approximately 10 feet.

The forested ridge would be planted to restore coastal live oak-hackberry forest, which is rated as critically imperiled and imperiled in Louisiana because of rarity (LDWF 2005a). The coastal ridge habitat would provide important habitat to migratory birds and other species. The ridge would also function as a barrier to further protect against impacts on Louisiana's only accessible and inhabited barrier island by reducing storm surge in Caminada Bay. Previous storms have demonstrated that a forested ridge on Fifi Island would protect infrastructure on Grand Isle during a storm, especially when winds and surge come from the north.

Current and Historical Conditions

Fifi Island and Grand Isle are two of many barrier islands that emerged from receding Mississippi River Delta lobes. Numerous hurricanes and the DWH Oil Spill demonstrated the advantage of robust barrier islands in providing shoreline resilience and reducing hurricane damage reduction. Louisiana's barrier islands protect inland populations from wind and wave action as well as storm surges generated by tropical storms and hurricanes. In addition, barrier shorelines are unique habitats that represent the foundation for complex and productive coastal ecosystems.

The restoration of barrier islands, including Grand Isle and Fifi Island, is part Louisiana's coastal master plan (CPRA 2017a) as well as a priority for other funding sources such as the RESTORE Act; the Coastal

Wetlands Planning, Protection and Restoration Act (CWPPRA); Coastal Impact Assistance Program; and NRDA. The alternative would expand upon and enhance multiple shoreline protection projects that have already been constructed or are planned around Grand Isle, Fifi Island, and Cheniere Caminada, including the following:

- **Grand Isle Bayside Segmented Rock Breakwater Project and Habitat Enhancements**: Construction of sixteen 350-foot bayside nearshore segmented breakwaters on the bay side of Grand Isle to bridge the existing gap in bayside breakwaters previously constructed to provide storm surge protection.
- **Grand Isle Beach Stabilization:** Restoration and shoreline protection of approximately 1 mile of Grand Isle beach and dune system.
- **Grand Isle and Vicinity Breakwater:** Stabilization of the western portion of beach and dune in Grand Isle by constructing beach, dune, and segmented rock breakwaters.
- **Grand Isle State Park Improvements:** Improvement of fishing and recreational use of the state park and protection of coastal, nearshore marine habitats and inland infrastructure. Upgrades to the existing fishing pier, extension of the rock jetty on the east shore of the park, and extension of the jetty on the north end of the park.
- **Caminada Headland Beach and Dune Restoration Increment 2:** Restoration and protection of 489 acres of beach and dune habitat across the Caminada Headland through the placement of approximately 5.4 MCY of sandy material from Ship Shoal (an offshore borrow source).
- **Grand Isle and Vicinity Hurricane Protection Project:** Construction of an approximately 7.5-mile vegetated sand dune extending the length of Grand Isle's Gulf shore, a jetty to stabilize the western end of the island at Caminada Pass, and an offshore breakwater system.

Restored Coastal Habitats

Approximately 22 acres and 6,000 linear feet of forested ridge on Fifi Island would be created by the alternative. These shoreline protection features would provide important habitat for migratory bird species and species and types of habitat that were directly impacted by the DWH. The breakwater and forested ridge would also serve as a barrier to further protect against impacts to Grand Isle, Louisiana's only accessible and inhabited barrier island, by reducing storm surge in Caminada Bay.

Construction Methodology and Schedule

Construction methods for the Fifi Island alternative would involve using an excavator to either excavate or backfill the footprint of the rock breakwater with rock gravel. Geotextile fabric would be placed over the fill prior to placing the breakwater. To facilitate construction of the breakwater, a temporary access channel would be dredged several meters off the shoreline along the length of the alternative because there is no upland access to the restoration area. The temporary access channel would be excavated using barge-mounted bucket excavators and associated crews. All excavated material would be placed behind the proposed and existing breakwaters to build the ridge, approximately 20 feet on the inland side of the breakwater.

The ridge would be constructed adjacent to a buried 20-inch oil or gas pipeline, which follows the length of the proposed ridge location. The design of the alternative would allow for gaps in the breakwater (Averill 2019). This pipeline is estimated to be at least 6 feet below the water line and would be protected during construction with matting (Averill 2019).

Marsh buggy and other track equipment would be confined to the alternative footprint. All equipment would be mobilized and demobilized by barge. Other construction machinery would include work boats and crew boats, quarters barge generators, welding machines, and miscellaneous vehicles. Silt curtains would be temporarily placed on all sides of the construction area to minimize turbidity and movement of sediment into the surrounding water. The total estimated construction time is 12 months.

Monitoring Requirements

Monitoring of the Fifi Island alternative would be conducted by the proponent in accordance with the mitigation plan required in the Coastal Use Permit (CUP)/Consistency Determination (P20140028). Jefferson Parish is currently seeking a modification to the CUP permit to cover the Fifi Island alternative.

3.2.4.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

Additional E&D would be needed for implementation of the alternative. Construction of the alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The onshore portion is on state-owned land, and the offshore portions of are within state-owned water bottoms. No new rights-of-way or in-fee land acquisitions would be required.

The total estimated cost for all restoration components of the Fifi Island alternative is $7,437,000 (NRDA funds) (Table 3.2-4). This includes construction, construction administration, construction supervision, inspection, and post-construction monitoring. The estimated cost represents an approximation given the current E&D status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-4. Construction Cost Estimate for the Fifi Island Forested Ridge with Breakwater Alternative

Description	Cost
E&D	$531,000
Construction	$6,906,000
Total (NRDA funds)*	**$7,437,000**

* The proponent of this alternative is not requesting funds for operations and maintenance or for monitoring.

The cost to implement the Fifi Island alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana’s public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by Jefferson Parish.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Fifi Island alternative is intended to address and restore the important linkages among and between wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Barataria Basin, the coastal wetlands of which provide foundational habitat for the Barataria Basin ecosystem, support resources within the Barataria Basin and throughout the Gulf of Mexico, and were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through forested ridge habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat, accelerate recovery of injured ecosystem functions, and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Fifi Island alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating approximately 22 acres of forested ridge habitat and approximately 1,200 linear feet of rock breakwaters. The benefits from the Fifi Island alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative. This documented experience and the successful completion of previous ridge creation and breakwater projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented with minimal delay after E&D completion. The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas.

Prevention of Future Injury and Avoid Collateral Injury

Ridge creation and breakwater projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The ridge and breakwaters that would be provided by the Fifi Island alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of surrounding marshes and wetlands. Further, ridge creation and breakwaters can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review is described in Section 4.5 and indicates that adverse effects from the project (turbidity, noise and other disturbances in the water column, habitat disturbance [including SAV and benthic habitats], EFH effects, behavioral changes to wildlife or protected species such as Gulf Sturgeon and manatee, etc.) would largely be minor, localized, and often short term. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of ridge habitat and breakwater shoreline protection restore important linkages among and between wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the alternative includes creating approximately 22 acres of forested ridge habitat and approximately 1,200 linear feet of rock breakwaters. The benefits from the Fifi Island alternative would extend to multiple resources injured both directly and indirectly in the alternative's footprint.

Public Health and Safety

The alternative would not affect public health and safety. Creation of the ridge included in this restoration alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.4.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Fifi Island alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the Fifi Island alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.5 Natural Recovery/No Action Alternative

The OPA regulations require that "Trustees must consider a 'natural recovery alternative' in which no human intervention would be taken to directly restore injured natural resources and services to baseline" (40 CFR 990.53[b][2]). This natural recovery alternative is synonymous with the "no action" alternative evaluated under NEPA. Under the natural recovery/no action alternative, the Trustees would not prepare a restoration plan nor implement future restoration projects under NRDA, other than those already approved through the Early Restoration process. The Trustees would allow the natural recovery process to occur, which could result in one of the four outcomes for injured resources: 1) gradual recovery, 2) partial recovery, 3) no recovery, or 4) further deterioration.

The Final PDARP/PEIS notes that interim losses of natural resources and the services natural resources provide would not be compensated under a natural recovery/no action alternative (DWH Trustees 2016: 5–92). Given that technically feasible restoration approaches are available to compensate for interim natural resource and service losses, the Trustees rejected this alternative from further OPA evaluation within the Final PDARP/PEIS. Based on this determination, tiering this RP/EA from the Final PDARP/PEIS, and incorporating that analysis by reference, the LA TIG did not evaluate natural recovery as a viable alternative under OPA in this RP/EA. For these reasons, the LA TIG rejects the natural recovery/no action alternative as a viable means of compensating the public for injuries to wetlands, coastal, and nearshore habitats caused by the DWH Oil Spill.

3.3 Oil Pollution Act Evaluation Conclusions

The LA TIG has completed its OPA evaluation of four restoration alternatives. The OPA analysis indicates that each of these would provide benefits to wetlands, coastal, and nearshore habitats with a strong nexus to injuries caused by the DWH Oil Spill. The alternatives would all occur in the Louisiana Restoration Area.

Each of the restoration alternatives has a clear nexus to the injuries described in the Final PDARP/PEIS because creation of marshes, oyster reefs, and breakwaters, and creation or enhancement of shorelines, dunes, and ridges would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternatives would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternatives would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

For all alternatives, the restoration approaches would ensure that any collateral damage to the environment is minor and minor and mitigated. Furthermore, no adverse impacts to public health are anticipated from any of the alternatives.

Based on the analysis above, all four alternatives would achieve restoration goals associated with the Wetlands, Coastal, and Nearshore Habitat restoration type. However, three of the alternatives, West Grande Terre, Golden Triangle, and Biloxi Marsh, do so on a much larger scale. The size of the Fifi Island alternative is small in scale (22 acres) compared to the other alternatives carried forward from the screening process; therefore, the net benefits are also smaller in scale. For these reasons, the LA TIG has determined that West Grande Terre, Golden Triangle, and Biloxi Marsh are the preferred alternatives for this RP/EA. The Fifi Island alternative could be considered in future restoration plans.

4 ENVIRONMENTAL ASSESSMENT

4.1 Introduction

Under NEPA, federal agencies must consider the environmental effects of their actions that include impacts on social, cultural, economic, and natural resources. The Final PDARP/PEIS evaluates a range of restoration approaches, thus enabling narrower NEPA analyses for subsequent restoration plans, such as this RP/EA. Subsequent restoration plans typically include project-specific actions (programmatic actions may also be tiered to the PDARP/PEIS), which are presented in this RP/EA as the proposed alternatives. Consistent with 15 CFR 990.23, this section presents the NEPA evaluation of the suite of reasonable alternatives as determined by the OPA evaluation in Section 3.

This RP/EA tiers from the Final PDARP/PEIS, and for this reason, the NEPA analysis herein refocuses from the programmatic scale of the Final PDARP/PEIS to this subsequent project-specific restoration plan prepared by the LA TIG (40 CFR 1502.4(b); 40 CFR 1508.28; 40 CFR 1502.20; see Chapter 6 of the Final PDARP/PEIS). As a tiered NEPA document, this RP/EA incorporates by reference relevant evaluations of the Final PDARP/PEIS's Chapter 3 (Ecosystem Setting) and environmental consequences from the Final PDARP/PEIS's Section 6.4.1 (Restoration Type: Wetlands, Coastal and Nearshore Habitats). This RP/EA is consistent with the Final PDARP/PEIS and ROD and provides a NEPA analysis for each proposed alternative, including whether the analyses of relevant conditions and environmental effects described in the Final PDARP/PEIS are still valid and whether impacts from the alternatives have already been fully analyzed in the Final PDARP/PEIS.

To determine whether an alternative has the potential to result in significant impacts, the context and intensity of the action must be considered. *Context* refers to area of impacts (local, statewide, etc.) and their duration (e.g., whether they are short- or long-term impacts). *Intensity* refers to the severity of impact and could include the timing of the action (more intense impacts would occur during critical periods like high visitation or wildlife breeding/rearing, etc.). *Intensity* is also described in terms of whether the impact would be beneficial or adverse. For purposes of this document, impacts are characterized as minor, moderate, or major, and short term or long term. The definition of these characterizations is consistent with Section 6 of the Final PDARP/PEIS (Appendix E).

The environmental consequences sections of this RP/EA analyze the beneficial and adverse impacts that would result from the implementation of any of the alternatives considered in this RP/EA.

Adverse is used in this section only to describe the federal Trustees' evaluation under NEPA. This term is defined and applied differently in consultations conducted pursuant to the ESA and other protected resource statutes. Accordingly, in the Protected Species sections below, there may be adverse impacts identified under NEPA; however, this does not necessarily mean that an action would result in a likely to adversely affect determination for that species under protected resources statutes. The results of any completed protected resource consultations are included in the administrative record.

4.1.1 Best Management Practices and Conservation Measures

Section 6, Appendix A of the Final PDARP/PEIS contains BMPs to avoid or minimize impacts protected and listed species and their habitats and are relied upon in the foregoing environmental consequences analysis for protected species. Additional BMPs that may be implemented as part of an alternative generally include design criteria, lessons learned, expert advice, and tips from the field. The environmental consequences described in Section 4.2 through Section 4.5 are presented largely without factoring in BMPs that could avoid or minimize the potential adverse impacts from an alternative, unless the BMPs are explicitly included in the environmental impacts analysis. However, BMPs that may be implemented to reduce potential impacts and would be established during project planning and implementation by the Trustees are provided in Appendix C.

4.2 West Grand Terre Beach Nourishment and Stabilization Alternative

4.2.1 Physical Resources

4.2.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The West Grand Terre alternative encompasses West Grand Terre Island, which is the most southeastern point of land in Jefferson Parish and Plaquemines Parish, Louisiana. West Grand Terre Island is on the Mississippi River Delta plain in the Barataria Basin, which is bounded by the Mississippi River on the east and the Bayou Lafourche on the west. West Grand Terre Island was part of a larger area, Grand Terre, which was formed through a process of delta lobes prograding and subsiding into the Gulf of Mexico that created beach ridges. Over time, Grand Terre was divided through wave action, storms, and sea level rise to form East and West Grand Terre Islands. West Grand Terre Island is accessible only by boat and includes undeveloped coastal land with a beach and dunes, marshland, and intertidal wetlands. Other features of the West Grand Terre alternative, including conveyance corridors, disposal areas, and a borrow area, extend off the island into Plaquemines Parish and the coastal waters of Barataria Basin.

The Barataria Basin is an interdistributary basin composed of poorly sorted sediments that are largely influenced by subsidence rates and transported sediment deposits (Roberts 1986: 435). The coastal marsh geology of West Grand Terre Island is characterized by Holocene back-barrier marsh and mangroves comprising fine sand and clay deposited over surface sandy washover deposits. The Gulfward edge of the island is characterized by Holocene beach sand comprising sand and shelly sand (Louisiana Geological Survey 2014). Surface soils on West Grand Terre Island are part of the Scatlake series, which comprises soils that are very poorly drained and semi-fluid soils with slopes less than 0.5% and elevations of approximately 1 foot about sea level (Matthews 1982: 53). These soils, which are found in saline marshes that are primarily ponded or flooded and surrounded by small ponds and perennial streams, are formed in unconsolidated saline clayey and organic sediments. Beach sediments on the island contain an average of 96.8% sand and 4.8% silt, with an average grain size of 0.167 mm. Borrow area sediments contain an average of 91.5% sand and 8.5% silt, with an average grain size of 0.157 mm. Substrates in the restoration area are primarily Scatlake muck that comprise soft muck and clay.

West Grand Terre Island has experienced persistent degradation and erosion. Sediments dredged during maintenance of Barataria Waterway by USACE were deposited on West Grand Terre in 1999 (618,000 cubic yards), 2002 (126,000 cubic yards), 2006 (688,000 cubic yards), and 2009 (480,000 cubic yards), helping to create up to 111 acres of marsh and 36 acres of beach. Despite these beneficial sediment deposits, the island has experienced shoreline and land changes due to subsidence and sea level rise, resulting in an overall sediment gain on the marsh side of the island and overall sediment loss on the shoreline of the island.

Environmental Consequences

The West Grand Terre alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

The use of onshore staging areas and construction activities on West Grand Terre Island would disturb substrate materials. Offshore activities, including anchoring of vessels and the use of equipment on the shoreline and on barges, marsh buggies, or other vessels to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of dredging disturbance in the borrow area would range from -56.0 feet to -70.0 feet NAV88.

The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to geologic changes. Sand fencing and vegetation would be installed in the dune and MCAs to prevent exposure of soils and sediments and reduce erosion.

The installation of the rock revetment and the placement of dredged materials in the restoration areas and overburden disposal area would result in compaction and sediment disturbance that would lead to localized changes to substrates and may affect sediment dynamics over the life of the alternative. Where the constructed rock revetment segments overlap with shoreline or land, existing substrates and geology would be permanently covered to protect the area from shoreline erosion.

Locating the overburden disposal area in an area where disturbance has previously occurred would reduce the overall area and intensity of disturbance that would contribute to erosion and would avoid changes to geology and substrate characteristics. The alternative’s design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by controlling erosion. Adverse impacts from construction and implementation of the alternative would be short term and minor.

Once completed, the restoration and enhancement of the Gulf beach, dune system, and marsh would provide long-term benefits to geology and substrates. The depositions of sediments in the MCAs and beach and dune systems would raise substrate elevations affected by subsidence and sea level rise, thereby helping to increase the resilience of the coastal wetlands. Restoration of the marshes and beach and dune areas would increase protection of the coastline from sea level rise and reduce shoreline erosion, and the rock revetment would reduce wave energies and currents on the shoreline of West Grand Terre. These, long-term benefits to geology and substrates from implementation of the alternative help restore and support natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

4.2.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

BASINS AND IMPAIRED WATERBODIES

The West Grand Terre alternative is in the Barataria Basin, between the Mississippi River to the north and east, the Bayou Lafourche to the west, and the Gulf of Mexico to the south. The topography of the Barataria Basin is marked by lakes, lacustrine deltas, distributary channels, crevasse splays, natural levees, drainage channels, and extensive swamps and marshes. The upstream portions of the basin are narrow and heavily influenced by freshwater, whereas the downstream portions range from open water to saltwater of the Gulf of Mexico that intrude marshes and lakes (Roberts 1986).

Open bodies of water in Barataria Basin include bays, lakes, and drainage channels that vary in size. The size of the waterbodies in the basin typically increases from north to south until the waterbodies merge into interdistributary bays, including Barataria Bay. Flows within the basin are variable throughout the year, with maximum and minimum flows usually occurring in the spring and fall, respectively. Barataria Bay, which is at the southern end of the basin on the north side of West Grand Terre Island, is a shallow, brackish waterbody with a mean depth of approximately 5 feet (3.1 m).

There are no fresh surface waterbodies on West Grand Terre Island. The waters around the island and in which the corridors, borrow area, and overburden disposal area would be located include Barataria Bay (subsegment 021101) and coastal bays and Gulf waters within the state 3-mile limit (subsegment 021102) (LDEQ 2004). There are no aquifers underlying West Grand Terre Island; the closest aquifer is the Mississippi River alluvial aquifer, approximately 40 miles north of the island (LDEQ 1988). Water levels in the alternative vary with storm surges and tides. Offshore water depths gradually increase seaward, reaching a depth of 18 feet (11.2 m) approximately 1.8 mile (3 km) from shore. Water depths along the corridor alignments vary from approximately -31 feet NAVD88 to 0 feet NAVD88 at the island.

The water quality of Barataria Basin is influenced by freshwater inputs (primarily rainfall) to the watershed and outflows from the Mississippi River. The waters surrounding the island (subsegment 021101) are listed as fully supporting Primary Contact Recreation (PCR), Secondary Contact Recreation (SCR), Fish and Wildlife Propagation (FWP), and Oyster Propagation (OYS) (LDEQ 2019a). The coastal bays and Gulf waters to southeast of the island (subsegment 021102) fully support PCR, SCR, and OP; however, this subsegment does not fully support FWP because of naturally occurring low dissolved oxygen levels, in addition to atmospheric deposition and unknown sources of mercury that have led to fish consumption advisories (LDEQ 2019a). Despite fish consumption advisories, fishing remains a popular activity around the island. Because of the lack of freshwater and the distance from significant pollutant sources, the island is not at risk of fecal coliform contamination.

WETLANDS AND FLOODPLAINS

Small islands of intertidal vegetated and coastal wetlands are scattered throughout Barataria Bay on the northside of West Grand Terre Island. These wetlands, and other wetlands along Louisiana’s coast, are major sources of carbon sequestration. Wetlands in the region have been deteriorating from subsidence and sea level rise, which have resulted in the conversion of uplands and wetlands to open water. A 2017 U.S. Geological Survey (USGS) report summarized wetland loss estimates published in the early 1990s for the Barataria Basin (USGS 2017). These estimates ranged between 5,200 acres per year (Dunbar et al. 1992) and 7,100 acres per year (Barras et al. 1994). USGS (2017) estimated another fifth of the basin’s wetlands could be converted to open water by 2045.

The western and eastern portions of West Grand Terre Island and surrounding waters are identified as Coastal Barrier Resources System Areas and Otherwise Protected Areas, respectively, which are located within or adjacent to Special Flood Hazard Areas (SFHAs) subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone) (Federal Emergency Management Agency [FEMA] 2018). The area surrounding the island that includes the alternative and a portion of the western extent of the conveyance corridor is SFHA Zone VE, which is a coastal flood zone with wave action hazards and a base flood elevation (BFE) of 11 feet. The area south of the island that captures the remaining extent of the conveyance corridor and the entire overburden disposal area and borrow area extents is SFHZ Zone V, which is also a coastal flood zone with wave action hazards but does not have a determined BFE.

Barataria Pass, separating West Grand Terre Island from Grand Isle to the west, provides tidal flow between Barataria Bay and the Gulf. Lunar tidal range is typically approximately 1.1 feet (0.34 m) but can be highly influenced by frequent wind tides and tidal currents. Tidal currents have scoured a deep natural channel in Barataria Pass between West Grand Terre Island and Grand Isle, where the pass is approximately 0.6 mile (1 km) wide and water levels fluctuate between 60 and 160 feet (18.2 and 48.8 m). Ebb and flood tidal deltas have formed at both ends of the scoured channel (Conatser 1971). The saline marshes on and around West Grand Terre Island are often ponded or flooded, and the shallow sea floor approaching the island facilitates storm surge flooding of coastal areas.

Following Hurricane Katrina, USACE constructed a system of barriers, sector gates, floodwalls, floodgates, and levees as part of the Hurricane and Storm Damage Risk Reduction System, which is managed by the state's flood protection authority (Southeast Louisiana Flood Protection Authority – East 2017a). As part of this system, 28 miles of levees/floodwalls, 730 acres of levee turn maintenance areas, and 12 land-based flood gates were constructed by Jefferson levee districts.

Environmental Consequences

Construction and implementation of the West Grand Terre alternative would result in short-term, minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

The disturbance of soils and sediments and increases in erosion during construction could lead to increased turbidity and sedimentation in nearby wetlands and waterbodies, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards. Sand fencing and vegetation would be installed in the dune and MCAs to reduce erosion and contribution of turbidity.

The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize impacts on hydrology, water quality, and wetlands by minimizing sediment and pollutant loads into waterbodies and controlling stormwater runoff. Therefore, construction and implementation of the West Grand Terre alternative would result in short-term minor adverse effects to hydrology, water quality, and wetlands.

Once completed, the restoration and enhancement of the Gulf beach, dune system, and marsh would provide long-term benefits to hydrology, water quality, and wetlands. The creation of marshes and dunes and renourishment of the beach would help coastal wetlands reconnect to tidal flooding, which would restore the natural hydrology of the island. Restoring the hydrology would support the reestablishment of natural estuarine salinity gradients and would help maintain and improve coastal water quality, benefiting coastal habitats and resources on West Grand Terre Island and other nearby areas. These long-term benefits to hydrology, water quality, and wetlands from implementation of the alternative would help restore and support natural hydrologic processes and improve overall coastal resiliency. The restoration of wetlands would provide long-term benefits to other resources, including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration, thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.2.1.3 AIR QUALITY

Affected Environment

West Grand Terre Island and nearby islands are uninhabited and only accessible by boat. As a result, air pollution sources on or near West Grand Terre Island and the borrow and overburden disposal areas are limited to infrequent boat traffic and small oil and gas processing facilities, including a small oil and gas facility located on the island. The closest major sources of air pollution occur in the urban-industrial corridor from New Orleans to Baton Rouge, which is at least 70 miles from the island. Other sources of air pollution come from the degradation of wetlands, which are major sources of carbon sequestration. It is estimated that wetlands store upward of 25% of global terrestrial carbon (Wang and Dodla 2013), and the large expanse of wetlands along Louisiana's coast account for some of the world's more significant pools of soil-sequestered greenhouse gases (Harms 2018).

Air quality monitoring stations are operated throughout the state by the LDEQ Air Planning and Assessment Division to determine compliance with National Ambient Air Quality Standards (NAAQS) for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM) 2.5 and 10, and sulfur dioxide (LDEQ 2019b). There are two air quality monitoring stations in the northern portion of Jefferson Parish near New Orleans: one in Marrero (EPA Air Quality Station [AQS] 220512001) and one in Kenner (EPA AQS 220511001). From 1995 through July 2019, the Jefferson Parish has been listed as an attainment area for all NAAQS (EPA 2019). There are no air quality monitoring stations in Plaquemines Parish.

Environmental Consequences

Short-term, minor adverse impacts to air quality would result from construction of the alternative. In-water and onshore construction activities during implementation of the West Grand Terre alternative would require the use of vehicles, machinery, and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term adverse impacts to air quality.

4.2.1.4 NOISE

Affected Environment

Because West Grand Terre Island is uninhabited and accessible only by boat, existing noise in the restoration, borrow area, and overburden disposal area is limited. The small oil and gas facility located on the island and transient vessel traffic are the only noise-generating sources in the area. Noise from distant urban areas and other oil and gas production facilities likely contribute negligible noise impacts to the alternative.

Environmental Consequences

The West Grand Terre alternative would result in short-term, minor adverse noise impacts. Construction of the alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials during construction. This adverse noise impact would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction, noise may attract their attention but would not affect their activities. The alternative would not result in long-term adverse noise impacts.

4.2.2 Biological Resources

4.2.2.1 HABITATS

Affected Environment

The alternative is in the Barataria Basin at the southern extent of the Mississippi alluvial plain and is located within the larger deltaic coastal marshes and barrier islands ecoregion, which is dominated by brackish and saline marshes (Daigle et al. 2006). West Grand Terre Island is part of a barrier island chain that separates Barataria Bay from the Gulf of Mexico. Barataria Pass, a natural tidal channel, is east of the island. Saltwater marsh, coastal dunes, and beaches are the prevalent ecologic features of the island. The alternative includes a tidal zone, an intertidal zone, natural and restored dunes, and a bayside zone of intertidal wetlands surrounded by mangrove and saltwater marsh habitat. The approximately 633-acre island consists of approximately 330 intertidal acres, 200 supratidal acres, 3 dune acres, and 100 subtidal acres (CEC 2018b). Freshwater inputs to the Barataria Basin are primarily rainfall because the construction of levees along the Mississippi River has prevented freshwater and sediment inputs to the basin.

Habitats on West Grand Terre Island include salt marsh, which is a regularly tidally flooded, flat, polyhaline area dominated by salt-tolerant grasses and few other species. Salt marsh in the area is largely dominated by smooth cordgrass broken up by areas of open water and the intertidal zone. CPRA's Coastwide Reference Monitoring System (CRMS) monitors approximately 390 sites throughout coastal Louisiana that cover a range of habitat types including fresh, intermediate, brackish, and salt marshes and swamps. There are no CRMS sites on West Grand Terre Island; however, sites are located approximately 5 miles east near Point Cheniere Ronquile (CRMS 0071) and 6 miles northwest near Raccoon Bayou (CRMS 0178). Dominant vegetation at these sites is smooth cordgrass (CPRA 2019a). Salt marsh habitats are considered important nursery areas for shrimp, crabs, and a variety of fish species and enhance the production of marine organisms in adjacent waters (Holcomb et al. 2015). Pockets of mangroves are present on the island. Salt marshes and mangrove habitats are integral parts of the Louisiana coastal island system. The intertidal zone consists of mudflat areas above water at low tide and occasionally under water at high tide, which provide important foraging habitat for breeding shorebirds. Invertebrates, such as crabs and clams, also inhabit the intertidal zone. Coastal dune habitat consists of scattered areas of shrubs such as groundsel bush (*Baccharis halimifolia*). Coastal dune communities can easily be destroyed by dune migration or erosion and replaced by grasslands. Bermuda grass (*Cynodon dactylon*), a nonnative species, is common around the facilities on the island (Coastal Environments 2013).

The island has been the recipient of beneficial dredging in the Barataria Bay Waterway (BWW) from 1996 through 2018. This dredging, conducted by the USACE, has added sand to the western end of the beach near Fort Jefferson and a created marsh on the landward side of the island. In 2001, approximately 300 acres of the new land created from dredge spoil on the east half of West Grand Terre was planted with bitter panicgrass, saltmeadow-marshhay cordgrass, smooth cordgrass, and black mangrove (*Avicennia germinans*) (CWPPRA 2018). No future dredge events are planned as of the writing of this document.

Submerged aquatic vegetation (SAV) can be found throughout Louisiana's coastal zone marshes and estuaries, typically on substrates that consist of sand/mud and in water depths of 4 feet or less. Estuarine seagrass beds are dominated by widgeon grass (*Ruppia maritima*) and water celery (*Vallisneria americana*), whereas the marine seagrass beds are dominated by turtle grass (*Thalassia testudinum*). Although small beds occur in ponds scattered throughout marshes of coastal Louisiana, the last remaining extensive seagrass beds are located along the north shore of Lake Pontchartrain and Barataria Basins and in and around the Chandeleur Islands approximately 50 miles northeast of the alternative (LDWF 2019a). The areas adjacent to the island and existing marshes may provide suitable conditions for SAV; however, no site-specific surveys have been conducted.

The borrow, overburden disposal, and conveyance areas generally consist of soft-bottom marine benthic habitats. The sediments in these areas are generally characterized by two layers: 1) an overburden layer of silts, clays, and fine sand and 2) a sand layer comprising fine sand with silt and clay. Water depths in the borrow areas range from approximately 27 to 34 feet (8 to 10 m) and from 5 to 26 feet (2 to 8 m) in the conveyance areas. Hydrographic and sonar studies show the seafloor to be generally featureless and gradually slopes from nearshore to offshore (CEC 2018b). The overburden disposal site is in an area that has been previously dredged. The borrow, overburden disposal, and conveyance areas area do not contain SAV (CEC 2019).

Environmental Consequences

Minor, short-term adverse effects to the marine, nearshore, and terrestrial habitats of West Grand Terre Island from construction could occur during structure removal, beach nourishment, and fill activities related to ground disturbance. These adverse impacts include increased potential for erosion and sedimentation and temporary habitat loss in terrestrial environments. In marine environments, minor, short-term adverse impacts may include a localized decrease in available dissolved oxygen and an increase in turbidity, temperature, and biological oxygen demand during sediment placement.

Restoration and nourishment of the beach and dune areas would widen the existing beach and improve and/or create approximately 251 acres of beach and dune habitat. Habitats that would be adversely impacted include beach and nearshore intertidal and subtidal sandy habitats. Ground disturbance may result in the loss of individual plants and habitat within the restoration footprint; however, these minor, short-term adverse impacts would be limited to localized areas, and similar habitats are available outside of the disturbance area. Additionally, because the dune platform would be revegetated immediately with native species, the overall disturbance of existing habitats would be short term. Restoration efforts that increase stability and resilience of dunes and beaches may result in long-term benefits to habitats, including increased areal extent and improvement of beach habitat. Restored beaches and dunes reduce erosion, scouring, and subsequent water quality impacts of storm surge events.

Creation of approximately 160 acres of marsh habitat would have minor, short-term adverse impacts on existing benthic and intertidal habitats near the fill area. The marsh fill area includes unvegetated beach and nearshore intertidal bay bottom habitat. As described in the affected environment, the nearshore intertidal bay bottom habitat may provide suitable conditions for SAV. The placement of dredged sediment within the marsh fill area would convert areas of open shallow water to intertidal marsh and may increase turbidity in aquatic habitats located near the marsh fill area in the short term. Sediment placement may result in the loss of individual plants and habitat within the marsh fill footprint; however, these impacts would be limited to localized areas, and similar habitat is available outside of the disturbance area. The newly created marsh area would be planted with native vegetation; therefore, the disturbance of existing habitat would be short term. In the long term, an increase in marsh habitat area would be beneficial for healthy barrier island vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats.

Construction of approximately 5,600 feet of rock revetment would result in minor, short-term adverse impacts to nearshore and benthic habitats. Similar to the impacts discussed above for the marsh fill activities, a short-term increase in turbidity of adjacent marine environments from ground-disturbing activities may occur. Minor, long-term beneficial effects from placement of rock revetments in marine environments include change of existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur.

As noted above, no SAV is present within the borrow areas, conveyance corridors, or overburden disposal area; therefore, no impacts to SAV are anticipated. Impacts associated with the conveyance corridors would result from laying sediment pipeline from the borrow areas to the beach-dune nourishment and marsh fill areas on West Grand Terre Island. These adverse impacts include short-term disturbance of benthic habitat and increased turbidity of marine environments and would be minor and short term. In the borrow areas, minor to moderate, short-term adverse impacts to benthic resources would occur as the overburden is removed from the borrow area. Long-term, benthic resources in disturbed areas would reestablish from adjacent undisturbed areas. Following fill operations, the conveyance corridor and borrow areas would return to ambient conditions and be recolonized by benthic populations within 1.0 to 2.5 years (Greene 2002; Michel et al. 2013) following construction.

Ground-disturbing activities could result in the spread of invasive species near the beach and dune nourishment and marsh fill areas of the alternative, which would be a minor, adverse, long-term impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.2.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

Wildlife species may inhabit the terrestrial and intertidal habitats on West Grand Terre Island. Mammals such as coyote (*Canis latrans*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethicus*), rabbit (Leporidae), squirrel (Sciuridae), opossum (*Didelphis virginiana*), and the nonnative nutria (*Myocaster coypus*) are likely present on West Grand Terre Island given the widespread distribution of these species in coastal Louisiana. With the exception of American alligator (*Alligator mississippiensis*) harvest data, little if any information exists regarding population status of amphibians and reptiles in the alternative. Species typically found in the Gulf salt marsh environments are the Gulf salt marsh snake (*Nerodia clarkii clarkia*), the Gulf Coast toad (*Bufo valliceps*), and the diamondback terrapin (*Malaclemys terrapin*) (Abernethy 1987), and these species may be present on West Grand Terre Island.

Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species, providing both year-round habitat for resident wildlife and important wintering or stopover habitat for migratory birds. The North American waterfowl management plan identifies coastal Louisiana as one of the most important regions for the maintenance of continental waterfowl populations in North America (North American Waterfowl Management Plan 2018). Coastal Louisiana is the terminus of the Mississippi Flyway, which is the largest waterfowl migration route in North America spanning from Canada to the Gulf of Mexico (USACE 2004). The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37. High-priority birds of concern common to the BCR are prothonotary warbler (*Protonotaria citrea*), sedge wren (*Cistothorus platensis*), Swainson's warbler (*Limnothlypis swainsonii*), and painted bunting (*Passerina ciris*) (Bird Studies Canada and NABCI 2014).

The intertidal zone provides important foraging habitat for breeding and overwintering shorebirds. Because of its location along the Mississippi flyway, many families of birds may be present and include waterfowl, wading birds, diving birds, colonial nesting birds, songbirds, shorebirds, migratory birds, seabirds, and raptorial birds. Many colonial waterbirds use mangroves as nesting areas; however, unlike the pelican and shorebird rookeries found on other Louisiana barrier islands, no known rookeries are present on West Grand Terre Island.

There is no official species list for the birds of West Grand Terre Island; however, 103 species have been observed on the island since 2010, with the most common being double-crested cormorant (*Phalacrocorax auritus*), lesser scaup (*Aythya affinis*), and laughing gull (*Leucophaeus atricilla*). Brown pelican (*Pelecanus occidentalis*) has also been observed on the island (eBird 2019). A species list from neighboring Grand Isle (approximately 0.5 mile southwest of West Grand Terre Island) reports 305 species (Lepage 2019). On Queen Bess Island (approximately 2 miles north of West Grand Terre Island), 63 bird species have been recorded (eBird 2019), including a variety of gulls, herons, night-herons, egrets, sandpipers, sparrows, terns, shorebirds, and waterfowl.

Environmental Consequences

Minor, short-term adverse impacts from construction may occur to wildlife individuals during structure removal, beach nourishment, and fill activities related to human noise and disturbance and habitat change or loss. Minor, short-term adverse impacts to wildlife individuals could occur during ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Other minor, short-term adverse impacts include the temporary loss of habitat during construction. However, such impacts would be localized and short term, and most wildlife individuals would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the beach nourishment and marsh fill activities. The creation of additional beach and dune and highly productive marsh habitat is anticipated to be ecologically beneficial. The creation of additional habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species could occur within the disturbance area. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential adverse impacts to resident and migratory birds. Therefore, adverse effects to these species would not be anticipated. Beach nourishment activities can result in minor, short-term adverse impacts to shorebirds from disturbance and reduced foraging efficiency if the birds are roosting and feeding in the area during a migration stopover. For example, the deposition of sand would temporarily deplete the intertidal food base during construction; however, intertidal areas are available outside of the beach nourishment areas and would provide foraging habitat. Potential adverse effects from the dredging, conveyance, and overburden disposal activities on birds would be limited to short-term, minor impacts that include disturbance in nearshore waters from increased vessel traffic. However, such impacts would be localized and short term, and impacted individuals would move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.2.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the island and the borrow, overburden disposal, and conveyance areas. On the back side of the island, the submerged bottom appears to be almost uniformly mud, except where storm overwash has created a veneer of sand. The wetlands, flats, and subtidal habitat around West Grand Terre Island provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Invertebrates such as crabs and clams also inhabit the intertidal zone. The marsh community provides highly productive nursery areas for shrimp, crabs, and fish. The cover and food mangroves provide create excellent nursery areas for fish and shellfish.

The most typical bottom substrate in the central Gulf of Mexico is soft muddy bottom where polychaetes are the dominant benthic organism. This soft-bottom marine habitat is present in the borrow, overburden disposal, and conveyance areas and can present a diverse assemblage of benthic species. Benthic habitats near the alternative support bacteria and algae. Dominant groups of benthic fauna are infauna (animals that live in the substrate, such as burrowing worms, crustaceans, and mollusks) and epifauna (animals closely associated with the substrate, such as crustaceans, echinoderms, mollusks, hydroids, sponges, and soft and hard corals). These may include protozoans, nematode worms and polychaete worms, decapod crustaceans, bryozoans, bivalve mollusks/oysters, sand dollars, gastropods/moon snails, oyster drills, and other interstitial fauna (Day et al. 1989). In addition, oysters have created their own hard-bottom substrate, in the form of oyster reefs, where conditions have been appropriate. Oysters are most abundant in shallow, semi-enclosed waterbodies (less than 12 m in depth) in areas where salinity levels are between 15 and 30 parts per thousand (VanderKooy 2012). Oyster leases are present along the northwestern side of the island (LDWF 2019b).

In Barataria Bay, 23 species of estuarine fish and 26 species of estuarine-marine fish have been documented (Thompson and Forman 1987). These include species such as bay anchovy (*Anchoa mitchilli*), Atlantic croaker (*Micropogonias undulatus*), Atlantic bumper (*Chloroscombrus chrysurus*), Gulf menhaden (*Brevoortia patronus*), spot (*Leiostomus xanthurus*), hardhead catfish (*Arius felis*), sand seatrout (*Cynoscion arenarius*), Atlantic threadfin (*Polvdactylus octonemus*), striped anchovy (*Anchoa heosetus*), and gafftopsail catfish (*Barge marinus*). The borrow, overburden disposal, and conveyance areas are in state waters approximately 5 miles from West Grand Terre Island. Fish species include a seasonal mix of tropical and temperate pelagic species (which is estimated at more than 100 species) as well as adult representatives of the benthic species encountered in Barataria Bay (Conner and Day 1987). Open water habitat for species such as gar (*Lepisosteus* spp.), catfish (Ictaluridae), bass (*Micropterus* spp.), Atlantic croaker, black drum (*Pogonias cromis*), sunfish (*Lepomis* spp.), and striped mullet (*Mugil cephalus*) is present.

Aquatic fauna requires healthy surroundings to survive and reproduce. Essential fish habitat (EFH) includes all types of aquatic habitat—wetlands, coral reefs, seagrasses, and mangroves—where fish spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act of 1996 is the primary law governing marine fisheries management in federal waters of the United States and fosters long-term biological and economic sustainability of the nation's marine fisheries out to 200 NM. The key objectives of the act are to prevent overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood. EFH is defined as "those waters and substrates necessary for fish to spawn, breed, feed, or grow to maturity" (Public Law 104-297). The designation and conservation of EFH seek to minimize adverse effects on habitat caused by fishing and non-fishing activities. Any federal agency that takes an action that could adversely affect EFH by reducing the quantity or quality of habitat must work with the National Marine Fisheries Service (NMFS) to identify impacts and steps for conserving the habitat and reducing the impact of the action (NOAA Fisheries 2019). NMFS has identified EFH habitats for the Gulf of Mexico in its fisheries management plan amendments. Three habitat zones are defined: estuarine (inside barrier islands and estuaries), nearshore (18 m [60 feet] or less in depth), and offshore (greater than 18 m [60 feet] in depth). Within the three habitat zones there are 12 defined habitat types: SAV, mangroves, drifting algae, emergent marshes, sand/shell bottoms, soft bottoms, hard bottoms, oyster reefs, banks/shoals, reefs, shelf edge/slope, and water column associated (WCA). The EFH components within the alternative include emergent wetlands, soft bottoms, and WCA.

The Gulf of Mexico Fishery Management Council (GMFMC) has delineated EFH for federally managed species in coastal Louisiana (GMFMC 2005). The alternative is in EFH Ecoregion 4 (East Texas and West Louisiana), which extends from the Mississippi Delta to Freeport, Texas. In the nearshore and estuarine open water and wetland habitats around West Grand Terre Island and in the borrow, overburden disposal, and conveyance areas, EFH has been designated for red drum (*Sciaenops ocellatus*), reef fishes (gray [mangrove] snapper [*Lutjanus griseus*], lane snapper [*Lutjanus synagris*], red snapper [*Lutjanus campechanus*], gray triggerfish [*Balistes capriscus*], greater amberjack [*Seriola dumerili*], and Almaco jack [*Seriola rivoliana*]), sharks (Atlantic sharpnose shark [*Rhizoprionodon terraenovae*], blacktip shark [*Carcharhinus limbatus*], blacknose shark [*Carcharhinus acronotus*], bull shark [*Carcharhinus leucas*], finetooth shark [*Carcharhinus isodon*], scalloped hammerhead shark [*Sphyrna lewini*], silky shark [*Carcharhinus falciformis*], and spinner shark [*Carcharhinus brevipinna*]), coastal migratory pelagic fish species (Spanish mackerel [*S. maculatus*] and cobia [*Rachycentron canadum*]), and shrimp (brown [*Panaeus aztecus*] and white shrimp [*P. setiferus*]) (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.2-1). Table 4.2-1 provides a description of each of these EFHs. The GMFMC and NMFS are also responsible for designating subsets of EFH called Habitat Areas of Particular Concern (HAPC) and EFH Areas Protected from Fishing (EFHA) for managed species. There are no HAPCs or EFHAs in the alternative.

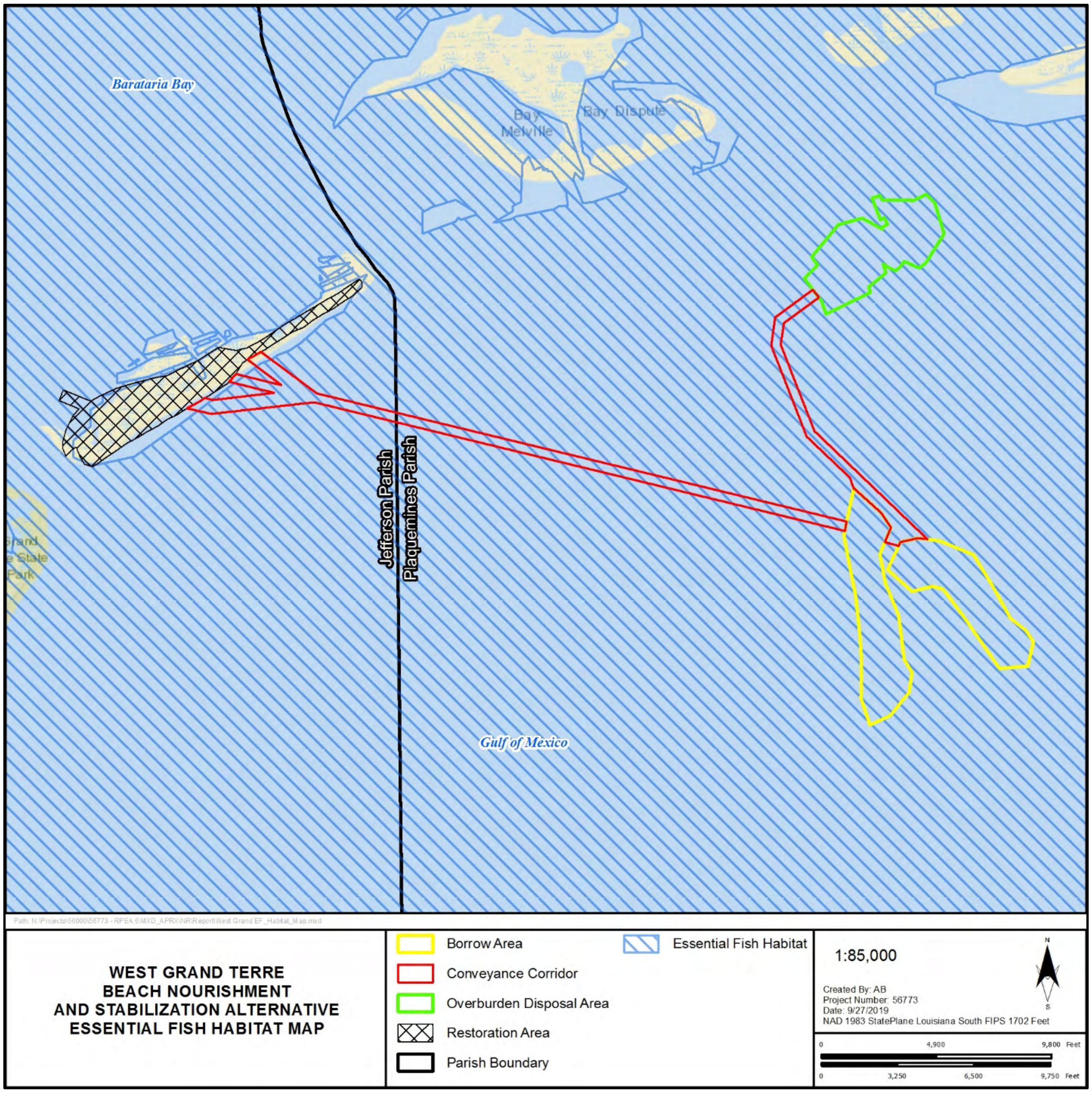

Figure 4.2-1. Essential fish habitat within the West Grand Terre Beach Nourishment and Stabilization alternative.

Table 4.2-1. Essential Fish Habitat for the West Grand Terre Beach Nourishment and Stabilization Alternative

EFH Species	Life Stage	Description
Red drum *(Sciaenops ocellatus)*	All	All Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana, to the eastern edge of Mobile Bay, Alabama, out to depths of 25 fathoms (1 fathom = 6 feet); waters and substrates extending from Crystal River, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; and waters and substrates extending from Cape Sable, Florida, to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms.
Reef fishes	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Juvenile/adult	Shallow coastal areas including bays and estuaries off Louisiana from the Atchafalaya River to Mississippi River Delta out to the 40-m isobath; coastal waters from Texas to the Florida Keys.
Blacktip shark (Gulf of Mexico stock) *(Carcharhinus limbatus)*	Juvenile/adult Neonate	Gulf of Mexico coastal areas, including estuaries, out to the 100-m-depth contour in the Gulf of Mexico from the Florida Keys to southern Texas; coastal areas of Mississippi and Louisiana, including Mississippi Sound, Mobile Bay, Terrebonne Bay, Timbalier Bay, and Chandeleur Sound; water depth ranging from 0.7 to 9.4 m in silt, sand, mud, and seagrass habitats.
Blacknose shark (*Carcharhinus acronotus*)	Adult	Shallow coastal waters in the Mississippi Sound from Mobile Bay, Alabama, to the waters off Terrebonne Parish, Louisiana, in waters with depths of 13 to 55 fathoms; coastal waters of Texas, western Louisiana, Mississippi, and Florida.
Bull shark *(Carcharhinus leucas)*	Juvenile/adult Neonate	Gulf of Mexico coastal habitats between Mobile Bay and Lake Borgne; coastal areas along Texas to the mouth of the Mississippi River, particularly the inland bay and bayou systems of Louisiana (i.e., interior of Lake Pontchartrain, the Pearl River system, Little Lake/Barataria Bay and its inland waters, the Terrebonne/Timbalier Bay system, and the Atchafalaya/Vermilion Bay system), the west side of Mississippi River Delta, and coastal areas along the Texas coast.
Finetooth shark *(Carcharhinus isodon)*	All	Gulf of Mexico shallow coastal waters of the northeastern Gulf of Mexico with muddy bottom (between depths of 1 and 3 fathoms) on the seaward side of coastal islands, especially around the mouth of the Apalachicola River and the Gulf side of St. Vincent Island to just southeast of St. Andrews Bay Inlet, Florida; St. Vincent Sound, Saint Andrew Sound, Saint Joseph Bay, and Apalachicola Bay, Bay St. Louis, Perdido Sound, Bon Secour Bay and lower Mobile Bay, Alabama; Terrebonne and Timbalier bay system, Louisiana (between depths of 0 and 3 fathoms); the Mississippi Sound between the islands and the coast of Louisiana; coastal areas of Texas, including portions of Corpus Cristi Bay, Aransas and Copano Bays, San Antonio Bay, Espiritu Santo Bay, Matagorda Bay, Galveston Bay, and Trinity Bay (between depths of 9 and 20 fathoms); and beaches of the southeastern Texas coast (between depths of 1 and 3 fathoms).
Scalloped hammerhead shark (*Sphyrna lewini*)	All	Gulf of Mexico; all shallow coastal waters from the shoreline out to the 50-m isobath, in the area of Mobile Bay, Alabama, and Gulf Islands National Seashore; coastal and offshore waters from Texas to Louisiana.
Silky shark (*Carcharhinus falciformis*)	Adult	Offshore waters in the Central Gulf adjacent to Texas, Louisiana, and the Florida Keys.
Spinner shark *(Carcharhinus brevipinna)*	Neonate	Gulf of Mexico coastal areas surrounding the Florida Keys and from the Big Bend Region to southern Texas; sandy bottom areas.
Coastal migratory pelagics	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.

EFH Species	Life Stage	Description
Shrimps	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to Fort Walton Beach, Florida, from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana, to Pensacola Bay, Florida, between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida, to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida, to Naples, Florida, between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.

Source: NOAA Fisheries (2019).

Environmental Consequences

Short-term, minor adverse impacts to benthic habitats during beach nourishment and marsh fill activities may occur from the placement of pipelines in the conveyance channels, dredging of the borrow areas, and placement of sediment in the footprint where existing shallow water and intertidal habitats would be covered. Disturbance of sediments during dredging and sediment placement may increase turbidity around these areas in the short term, which could adversely affect sensitive benthic habitats such as oyster reefs and seagrasses (Michel et al. 2013). Slow-moving or sessile benthic organisms found within the borrow areas and intertidal footprints of the beach nourishment and marsh fill site may be adversely impacted through removal or burial, respectively. More mobile benthic species would likely be displaced in the short term, whereas potential for removal or burial would be localized and confined to construction areas. Sediment placement may also adversely impact benthic fauna in both the beach and intertidal zones by covering them with a layer of sediment. Some benthic species can burrow through a modest layer of added sediment; however, thicker layers of sediment are likely to smother the benthic fauna (DWH Trustees 2016). In areas where the depth of sediment placement would exceed the burrowing limits for benthic species, there would be an increased likelihood of localized loss of existing benthic fauna. However, BMPs such as silt curtains, buffer zones, and water quality monitoring would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often generally within 1 year and achieving community composition similar to undisturbed sites in 2.5 years (Greene 2002; Michel et al. 2013). In the long term, the footprint of hard structures, such as rock revetments, changes existing habitat from a soft to a hard substrate and would have beneficial effects to the benthic community. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur, often such as oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

During construction, short-term, minor adverse impacts to marine species habitats may occur through sediment deposition and increased turbidity. The conversion of shallow open water habitat to intertidal marsh could result in long-term, minor adverse impacts to habitat; however, this impact would be offset by the long-term ecological benefits from restoring intertidal marsh. Productive marsh habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open ocean ecosystems through the movement of animals that use wetlands during their life cycle to grow and reproduce. Many of the species that use coastal marshes as juveniles later move offshore where they may serve as prey for open ocean species. Beach habitats contribute to the quantity and quality of adjacent shallow water habitats that serve as nurseries or forage areas for marine species, and the beach-shallow water interface also provides nutrient exchange to aquatic habitats. Overall, beach nourishment and marsh creation would provide long-term benefits for many marine species, including fish, shrimp, and shellfish in the form of food, shelter, breeding, and nursery habitat.

Short-term, minor adverse impacts may include effects to EFH during dredging and fill-related activities. During these activities, species and their prey species may leave the borrow area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in disturbance of feeding or spawning and other behaviors by some species individuals in the short term. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed restoration of marsh habitat would result in long-term benefits to marine and estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh restoration would also benefit species within the ecosystem by contributing to the marine food web and providing a more productive habitat.

4.2.2.4 PROTECTED SPECIES

Affected Environment

Protected species include wildlife and plant species that are protected from harm or harassment by law. The ESA protects all federally listed wildlife and plant species, and designated critical habitat of these species, in the United States. The ESA requires that federal agencies ensure that any action authorized, funded, or carried out by an agency is not likely to jeopardize the continued existence of any listed species, or result in the destruction or adverse modification of designated critical habitat. Other protected species include marine mammals (e.g., the common bottlenose dolphin [*Tursiops truncatus*]) protected by the Marine Mammal Protection Act of 1972 (MMPA) and migratory birds (see Section 4.2.2.2) protected by the Migratory Bird Treaty Act of 1908 (MBTA). Another statute, the Bald and Golden Eagle Protection Act of 1940 (BGEPA), further protects eagles within the United States. The primary regulatory agencies responsible for ESA compliance are USFWS and NMFS. *Critical habitat* is defined as areas containing the physical or biological features essential to a listed species' conservation, and is designated when it is both "prudent and determinable." These features are referred to as primary constituent elements. Any action authorized, funded, or carried out by an agency is prohibited from destroying or adversely modifying designated critical habitat.

The West Grand Terre Beach alternative analysis area for protected species is a 1-mile buffer around all potential disturbance areas and includes portions of Jefferson and Plaquemines Parishes. Ten species are listed as threatened or endangered within these two parishes (Table 4.2-2). This species list was developed using the USFWS Information for Planning and Consultation (IPaC) resource list for both parishes (USFWS 2019a).

Table 4.2-2. Federally Protected Species under the Endangered Species Act and Marine Mammal Protection Act for Orleans and St. Bernard Parishes

Common Name	Scientific Name	Federal Status*	Parish	Habitat Description†
Piping plover	*Charadrius melodus*	T	St. Bernard	In Louisiana, winters on intertidal beaches with sand and/or mudflats with no or very sparse vegetation.
Red knot	*Calldris canatus rufa*	T	St. Bernard	Winters on barrier island systems in southeastern Louisiana.
Gulf sturgeon	*Acipenser oxyrinchus* (=*oxyrhynchus*) *desotoi*	E	Orleans and St. Bernard	All saltwater habitats. Found in major rivers that empty into the Gulf of Mexico during spawning season (such as the Pearl River Basin and Lake Pontchartrain Basin).
Pallid sturgeon	*Scaphirhynchus albus*	E	Orleans and St. Bernard	Prefers main channels of excessively turbid rivers in areas with strong currents over firm sandy bottoms. Found in the Atchafalaya River Basin, Mississippi River Basin, and Lake Pontchartrain Basin.

Common Name	Scientific Name	Federal Status*	Parish	Habitat Description†
West Indian manatee	*Trichechus manatus*	T	Orleans and St. Bernard	Found in freshwater and saltwater habitat of canals, creeks, lagoons, or rivers, in areas with access to natural springs or warm water (in winter), and to areas with vascular plants and freshwater sources.
Hawksbill sea turtle	*Eretmochelys imbricate*	E	St. Bernard	Found in warm bays and shallow portions of oceans, such as seagrass beds and estuaries. Nesting occurs on mainland beaches and islands.
Green sea turtle	*Chelonia mydas*	T	St. Bernard	Found in warm bays and shallow portions of oceans, such as seagrass beds and estuaries. Nesting occurs on mainland beaches and islands.
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	St. Bernard	Found in warm bays and coastal waters, such as seagrass beds, tidal rivers, and estuaries. Nesting occurs on mainland sandy coastal beaches.
Leatherback sea turtle	*Dermochelys coriacea*	E	St. Bernard	Found in open ocean and deeper waters of the Gulf and coastal bays. Nesting occurs on coastal beaches and barrier islands.
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta caretta*	T	St. Bernard	At different life stages this species can be found in coastal waters, including estuaries, and deep ocean. Nesting occurs primarily on ocean beaches and occasionally on estuarine beaches with coarse-grained sands.

* USFWS Status Definitions

E = Endangered. Endangered species are those in imminent jeopardy of extinction. The ESA specifically prohibits the take of a species listed as endangered. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

T = Threatened. Threatened species are those in imminent jeopardy of becoming endangered. The ESA prohibits the take of a species listed as threatened under Section 4d of the ESA. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

† Range or habitat information is from USFWS Louisiana Ecological Services Field Office (USFWS 2019a) or LDWF (LDWF 2019c).

Of these 10 species listed as threatened or endangered within these two parishes, Gulf sturgeon, West Indian manatee, piping plover (*Charadrius melodus*), red knot (*Calldris canatus rufa*), and all five species of sea turtles (hawksbill sea turtle [*Eretmochelys imbricate*], green sea turtle [*Chelonia mydas*], Kemp's Ridley sea turtle [*Lepidochelys kempii*], leatherback sea turtle [*Dermochelys coriacea*], and loggerhead sea turtle [*Caretta caretta*]) are listed as being potentially present in the area by the USFWS IPaC resource list (USFWS 2019a). Of these species, the alternative and vicinity may provide habitat for West Indian manatee, piping plover, red knot, and three species of sea turtles (hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle).

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending on its life stage and on the season (NOAA Fisheries 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). The alternative is located within historical Gulf sturgeon range but outside of the species' current range and designated critical habitat in Lake Borgne and Lake Pontchartrain.

Habitats suitable to support marine vegetation that could attract the West Indian manatee may be present within the alternative. However, no known occurrences of this species have been documented within the alternative; thus, occurrences of this species is rare and there is a low probability the species would occur in the alternative (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within the alternative.

Three of the five species of sea turtles have potential to occur near the alternative (USFWS 2019a): hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle. Because the nearshore habitats of the alternative do not provide suitable foraging habitat for hawksbill or leatherback sea turtles it is unlikely that these species would be present (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). Of these three species, only the loggerhead sea turtle may nest within the alternative; the remaining two species (Kemp's Ridley and green sea turtles) would be present but only within the marine environments of the alternative. The loggerhead sea turtle is the most common sea turtle species in Louisiana. Most sea turtle species are not known to nest in Louisiana because of the lack of suitable nesting habitat; however, loggerhead sea turtle nests have been observed on Grand Isle, which is approximately 0.5 mile west of West Grand Terre Island. Because similar beach habitat is also present on West Grand Terre Island, loggerhead sea turtles may use the terrestrial habitats of the alternative for nesting. Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for Kemp's Ridley and green sea turtles, these species are not expected to use terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The green and Kemp's Ridley sea turtles may be present within the alternative because the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe2016). Loggerhead sea turtles may also be present in the shallow waters of the alternative for feeding.

Piping plover and red knot wintering habitat is present in and around the alternative and includes beaches, tidal sand flats, mudflats, algal mats, washover passes, and small dunes where they feed primarily on small invertebrates (Campbell 2003).

Piping plover designated critical habitat is present on Grand Isle and East Grand Terre islands, adjacent to the alternative (Figure 4.2-2). Piping plover designated critical habitat is located all along the southeastern shoreline of Grand Isle and other neighboring barrier islands, including East Grand Terre Island (Unit LA-5). Grand Isle is approximately 0.5 mile west of West Grand Terre and East Grand Terre is approximately 1.0 mile to the east. This designation applies to suitable overwintering habitats on the beaches, mudflats, and estuarine wetlands abutting and adjacent to the Gulf of Mexico. Primary constituent elements for piping plover overwintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. The elements include intertidal flats, including sand and/or mudflats with no or very sparse emergent vegetation, and adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide, which are important for roosting plovers.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents the estuarine area near West Grand Terre Island. The Atlantic spotted dolphin (*Stenella frontalis*) does not frequent inshore areas but occurs in nearshore shelf waters; therefore, this species may be present near the borrow and overburden disposal portions of the alternative (Hayes et al. 2019).

Bald eagles (*Haliaeetus leucocephalus*) are known to breed and winter near the alternative.

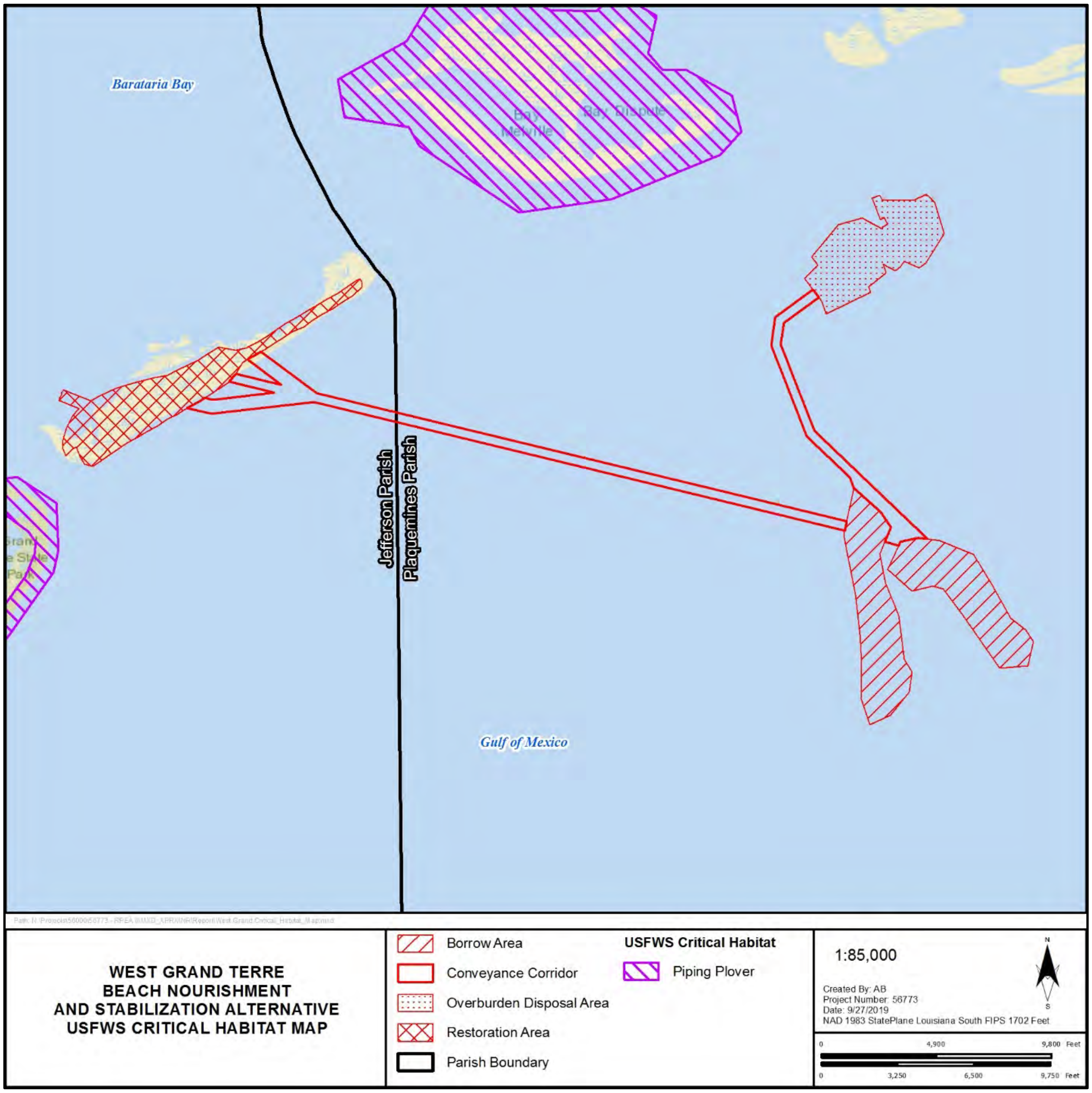

Figure 4.2-2. Critical habitat within West Grand Terre Beach Nourishment and Stabilization alternative.

Environmental Consequences

Activities that may affect manatees present in and around the alternative are construction-related in-water work that would include dredging, beach nourishment, marsh fill, overburden deposition, and placement of conveyance pipelines. These activities could result in adverse impacts from temporary localized turbidity and construction noise that may result in avoidance behaviors. Other adverse impacts include the potential for collision with vessels/barges and entanglement with anchor management systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential impacts to this species. Adherence to the protection measures would help prevent adverse effects to any manatees that may be present in the area of disturbance associated with construction of the alternative. The disturbance to manatee, if present in the area, would be short term, limited to construction, and resulting in temporary displacement of individuals that would likely move to another area for foraging or resting purposes. In the long term, an increase in marsh habitat area would be beneficial for healthy barrier island vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats, which could contribute to improved conditions for SAV in the region.

Activities in beach habitat that could adversely impact piping plover and/or red knot include beach nourishment and would result in temporary, localized construction noise and human activity that may result in avoidance behaviors. Other impacts may include temporary effects to prey species within the beach nourishment footprint; however, individual piping plover and red knot would likely move to another area for foraging purposes. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS, including seasonal avoidance of construction in important wintering habitats when piping plovers are present (approximately late July through mid-May) or when red knots are present (approximately August through mid-May), would be implemented to reduce potential disturbance. As these species have been documented on the beaches in the area, restoration of beach habitat may be beneficial in the long term via increasing total available habitat for these species (deMay et al. 2016).

Adverse impacts to the terrestrial life stage for the loggerhead sea turtle would include potential disturbance of nesting habitat as a result of beach nourishment activities; however, these activities could ultimately benefit the loggerhead sea turtle in the long term by increasing suitable nesting habitat in the area. Adverse impacts to the marine life stage of this species would be similar to those described for the other sea turtle species below. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to this species. In the long term, impacts associated with the beach restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit this species.

Construction activities associated with the West Grand Terre alternative may result in adverse impacts to the marine life stages for Kemp's Ridley and green sea turtles. The in-water work of beach nourishment, marsh fill, dredging of the borrow areas, and disposal of overburden may result in temporary increases in turbidity and construction noise that may result in avoidance behaviors. Dredging and conveyance activities are expected to last approximately 16 months and thus these activities are not anticipated to cause long-term behavioral changes. Other adverse effects of construction may include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. In the long term, impacts associated with the beach restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit these species.

Although the alternative overlaps piping plover critical habitat on Grand Isle, no adverse effects from the alternative are expected to impact critical habitat. Grand Isle is approximately 0.5 mile away from West Grand Terre and therefore activities related to beach nourishment and shoreline stabilization on West Grand Terre Island would not adversely affect the foraging, sheltering, or roosting needs of piping plovers within critical habitat.

Bald eagles in and around the alternative may be sensitive to changes in noise sources or levels due to construction. However, potential adverse impacts to bald eagles would be limited to temporary disturbance of individuals and potential foraging habitat because the alternative does not contain elements (such as trees) that would provide suitable breeding or roosting habitat. The alternative would include BMPs described in Section 6, Appendix A of the Final PDARP/PEIS. Potential short-term adverse impacts to bald eagles would be minimal.

Potential impacts to dolphins would be similar to those discussed for West Indian manatee.

4.2.3 Socioeconomic Resources

4.2.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The West Grand Terre alternative is located within Jefferson Parish and Plaquemines Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the Census tracts in which the alternative would be located (Census tracts 279.02, 504, 9900, and 9901), Jefferson Parish, Plaquemines Parish, state of Louisiana, and the U.S. Census tracts are statistical subdivisions of a county and are roughly equivalent to a neighborhood, therefore providing socioeconomic indicators appropriate for characterizing localized areas. These data are summarized in Table 4.2-3.

Table 4.2-3. Demographic, Economic, and Social Data for the West Grand Terre Beach Nourishment and Stabilization Alternative

Description	Census Tract 279.02	Census Tract 504	Census Tract 9900	Census Tract 9901	Jefferson Parish	Plaquemines Parish	Louisiana	United States
Total population	1,872	3,236	0	0	437,038	23,394	4,663,461	321,004,407
Total minority population*	1	1,274	0	0	152,577	6,519	1,670,819	76,872,258
Population under the age of 5	93	40	0	0	27,903	1,659	310,431	19,853,515
Population 65 and older	374	649	0	0	68,345	2,782	655,848	47,732,389
Median age	50.3	45.4	–	–	39.0	35.9	36.4	37.8
Median household income (dollars)†	$41,977	$32,395	–	–	$50,868	$49,635	$46,710	$57,652
Population below poverty level (%)	23.9%	24.2%	–	–	16.3%	19.3%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	357	367	0	0	46,219	2,705	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The populations in Jefferson Parish and Plaquemines Parish make up 9.4% and 0.5%, respectively, of Louisiana's population. Jefferson Parish has a minority population of approximately 35%, which is about the same as the minority population of Louisiana (36%) and more than the overall United States (approximately 24%). Plaquemines Parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the minority population overall in the United States.

Most of the West Grand Terre alternative is in Census tract 279.02, which also includes a portion of the borrow area that extends into Census tracts 504 and 9900. The conveyance corridors extend from Census tract 279.02 into Census tracts 9901 and 9900, and the overburden disposal areas are in Census tracts 504 and 9900. Census tracts 9900 and 9901 are uninhabited and are therefore not further discussed for the alternative.

The percentage of minority residents in Census tract 279.02 (approximately 0.05%) is less than the parishes, state, and country. The population under the age of 5 (approximately 5%) is comparable to Jefferson Parish (6.5%), Plaquemines Parish (7.1%), Louisiana (6.7%), and the United States (6.2%). The median age of 50.3 is more than 10% greater than the parishes, state, and country. The median household income for Census tract 279.02 ($41,977) is approximately 19% lower than Jefferson Parish, 17% lower than Plaquemines Parish, 11% lower than the state, and 32% lower than the country. The population living below the poverty level (23.9%) is lower for this Census tract, which is higher than Jefferson and Plaquemines Parishes, Louisiana, and the country. In addition, the population with a less-than-high-school degree within Census tract 279.02 (19.1%) is more than Jefferson Parish (10.6%), Plaquemines Parish (11.6%), Louisiana (10.4%), and the United States (8.5%).

Minority residents make up approximately 39% of Census tract 504, which is more than Jefferson and Plaquemines Parishes, Louisiana, and the overall United States. Because the minority population of Census tract 504 is more than 10% of the general population, which is represented by Plaquemines Parish (27.9% minority population), it is a significant area of environmental justice populations. In this Census tract, the population under the age of 5 (1.2%) is lower than the populations in the parishes, state, and country, but the median age of 45.4 is higher. The median household income for Census tract 504 ($32,395) is 44% lower than Jefferson Parish, 42% lower than Plaquemines Parish, 36% lower than Louisiana, and 56% lower than the country. The population living below the poverty level (24.2%) is higher than the parishes, state, and country. The population with a less-than-high-school degree within Census tract 504 (11.3%) is higher than Jefferson Parish, Louisiana, and the United States, but similar to Plaquemines Parish.

Environmental Consequences

The West Grand Terre alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative would not require displacements or demographic shifts from implementation of the alternative and the proposed activities for which would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may resulted in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparently and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Although Census tract 504 is a significant area of environmental justice populations, no adverse effects to environmental justice populations are anticipated because of the semi-remote location and small size of the alternative as it relates to available fishing areas. If members of the environmental justice population engage in subsistence fishing in or near West Grande Terre Island, the fishing opportunities would continue in adjacent areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally, adversely affected from construction and implementation of the West Grand Terre alternative.

4.2.3.2 CULTURAL RESOURCES

Affected Environment

An archaeological assessment of the West Grand Terre alternative was conducted from June 2 through 13, 2018. The assessment focused on the proposed borrow areas and conveyance corridors located offshore West Grand Terre Island and resulted in approximately 1,384 acres (560 hectares) surveyed. Review of remote sensing data identified 211 magnetic anomalies and five side scan sonar contacts. Bathymetric and sub-bottom profiler data also were incorporated into the assessment. No relict geomorphic features deemed potentially archaeologically significant were identified within the area of potential effect (APE) for the borrow areas and conveyance corridors. As a result of the assessment, four archaeological targets indicative of submerged cultural resources were noted within the APE (R. Christopher Goodwin and Associates, Inc. 2018).

An archaeological field investigation of the West Grand Terre alternative was conducted in May 2019 and focused on the submerged portion of the Lafitte Settlement (site 16JE128), which overlaps with the restoration area portion of the alternative. The portion of 16JE128 within the APE associated with the restoration area has been recommended not eligible for the National Register of Historic Places (NRHP), and no additional investigations of the portion of the site within the APE is recommended based on the result of the 2019 investigation (R. Christopher Goodwin and Associates, Inc. 2019).

The LDWF lab is an abandoned scientific research and investigation facility built in 1957 to support Louisiana’s fishing industry. It is located on the west end of West Grand Terre Island and was surveyed in January 2019. The facility no longer retains integrity to convey its significance and the Louisiana State Historic Preservation Office (SHPO) has concurred that facility is not eligible for the NRHP (Louisiana Division of Historic Preservation 2019). Therefore, impacts to the LDWF lab are not discussed under environmental consequences.

Fort Livingston is a nineteenth century defense fort located on the west end of the West Grand Terre Island. The fort was listed in the NRHP in 1974. The West Grand Terre alternative would avoid direct impacts to the Fort Livingston property; therefore, impacts to this resource are not discussed under environmental consequences for cultural resources.

Environmental Consequences

The four archaeological targets indicative of submerged cultural resources are in the borrow area. These anomalies would be avoided by a minimum distance of 50 m (164 feet) from the edges of the anomaly.

The alternative would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Disturbance of the seafloor during construction activities has the potential to encounter and cause long-term adverse impacts to unidentified submerged cultural resources. Although remote sensing surveys conducted in accordance with current professional standards for cultural resource identification are expected to be highly effective at recognizing submerged cultural resources, the possibility of encountering an unidentified and unanticipated submerged cultural resource, however unlikely, is always present during dredging and construction activities. Impacts to portions of historic properties that damage characteristics that make them eligible for the NRHP are long term and irretrievable. Restoration measures and management actions, such as avoidance buffers around the four archaeological targets, would be designed to avoid cultural resources to the extent practicable.

Consultation with affected tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative. Consultation with the Louisiana SHPO regarding the offshore cultural resource survey findings is currently ongoing.

4.2.3.3 INFRASTRUCTURE

Affected Environment

West Grand Terre is completely uninhabited, so there is limited infrastructure on the island and no public infrastructure.

On the western side of West Grand Terre is the LDWF lab, a small abandoned marine research laboratory. The LDWF lab was established by LDWF in the late 1950s. The LDWF lab complex included a laboratory, three dormitories, a radio tower, three water storage tanks, a cistern, a maintenance workshop, a boat maintenance shed, a boat lift, a boat shed, two sets of fisheries research ponds, and an access channel (Providence 2018a). The LDWF lab complex was heavily damaged by Hurricane Katrina in 2005 and Hurricane Gustav in 2008 and was abandoned shortly thereafter. The LDWF built a new Fisheries Research Laboratory on Grand Isle, which opened in July 2009, relocating the research activities previously conducted at the LDWF lab. Currently, the buildings that made up the LDWF lab are in various states of disrepair and require demolition, removal, and disposal.

On the eastern bayside of the island is an existing oil and gas facility operated by Hilcorp Energy with electricity provided by Entergy. There is a submerged electrical line from Grand Isle that crosses Barataria Pass and enters the island through a pull box just south and east of Fort Livingston. The submerged electrical line continues through two more pull boxes, approximately 300 feet east of the initial box to a 45-foot power pole, which is the first of nineteen poles that carry an overhead electrical line across the island from the southwest to the Hilcorp Energy facility to the northeast (Roussell 2018).

Environmental Consequences

Construction of the West Grand Terre alternative would result in short-term, minor adverse impacts to infrastructure. The alternative would result in no long-term adverse impacts to infrastructure. Because of the limited infrastructure and users of that infrastructure, impacts could include localized interruptions to access, public services and utilities. Impacts to utilities (including electrical utilities [Entergy]) and public service would likely be localized and within operational capacities. These impacts may include unintended interruptions to service and outages, as well as reduced access for the utilities to conduct maintenance activities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing electrical and oil and gas infrastructure in the alternative. The location of borrow areas for the alternative was sited to avoid impacts to existing oil and gas infrastructure in the alternative. In order to minimize any potential impacts, prior to any ground disturbance activities the contractor would coordinate with utility operations and pipeline companies and would adhere to the following special provisions as provided in the provisions and specifications for the alternative (CPRA 2019b) and BMPs for infrastructure in Appendix C.

Before construction of the alternative, portions of the abandoned LDWF lab would be removed. This would result in no adverse impact to the LDWF lab because the lab is previously abandoned and is not in use.

4.2.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

West Grand Terre is located within Jefferson and Plaquemines Parishes. West Grand Terre Island forms the western end of the Barataria Basin barrier island system and is the most southeastern point of land in Jefferson Parish, Louisiana. Fort Livingston on the Island is managed by the Louisiana Office of State Parks and is designated a State Cultural Area, part of Grand Isle State Park. The Barataria Pass is managed as part of the BWW for navigation by the USACE. The borrow area for the alternative is located approximately 4.6 NM east-southeast of the center of West Grand Terre Island.

Jefferson Parish lies within the Louisiana Coastal Zone established by the State and Local Coastal Resources Management Act of 1978 (Act 361). Jefferson Parish established the Jefferson Parish Coastal Zone Management (CZM) Program in 1984, which was approved by the state on January 4, 1985. Jefferson Parish's CZM is consistent with the state guidelines and with the policies and objectives of Act 361 (Jefferson Parish 2019). The alternative is within the Grand Isle Management Unit, which includes management goals of marsh restoration, beach stabilization, flood control, and erosion control on the islands (Jefferson Parish 1984).

Plaquemines Parish lies entirely with Louisiana's coastal zone. Plaquemine's current local CZM program is an update to the program that was approved by Plaquemines Parish Council in 2000. The local CZM program is consistent with the State of Louisiana's Coastal Resources Management Act, as amended, and the state guidelines. The alternative intersects the Barataria Bay Environmental Management Unit (EMU). Goals for this EMU within the Plaquemines CZM are similar to those in the Jefferson Parish CZM. These goals include reducing land loss; creating new wetlands; maintaining, protecting, and/or restoring barrier islands, headlands, and adjacent wetlands as hurricane buffer zones; encouraging the USACE and others to use dredged material to restore and maintain barrier islands and shorelines; plugging canals and breaches, and/or creating wetlands; and using existing and newly created wetland as storm buffer zones (Plaquemines Parish Department of Coastal Zone Management 2013).

Environmental Consequences

This alternative would not result in adverse impacts to land and marine management. Implementation of the West Grand Terre alternative would provide long-term benefits to land and marine management. The alternative would result in the creation and restoration of habitat and protection of shoreline along West Grand Terre Island. A CUP is required for implementation of the West Grand Terre alternative. In October 2018, the applicant submitted a CUP/Consistency Determination to the LDNR Office of Coastal Management. A CUP/Consistency Determination was issued on May 18, 2019, which demonstrates compliance with the Coastal Zone Management Act (CZMA). The alternative is consistent with the goals of 2017 coastal master plan (CPRA 2017a) and with state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Therefore, the alternative would not result in any changes to land and marine management because it would be consistent with the current parish and coastal management, practices, and plans. The alternative would assist both parishes in achieving CZM goals of protecting and improving shorelines.

4.2.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

There are limited opportunities for tourism and recreational use at West Grand Terre Island because of its uninhabited nature. The waters around the island and over the borrow area and overburden disposal area provide opportunities for recreational angling but do not provide attractions for recreational snorkeling or SCUBA diving. Recreationally important fish species such as spotted seatrout (*Cynoscion nebulosus*), red drum, black drum, and southern flounder (*Paralichthys lethostigma*) use the barrier island habitats and are the target species for anglers. Fort Livingston is listed on the NRHP and is a recreational attraction; however, it is only accessible by boat, which limits access and use. There are no readily available recreation numbers for Fort Livingston.

Environmental Consequences

The alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary, localized impacts to recreational experiences, such as fishing, from interruptions to recreational activities or visual interference or obstruction from construction. These short-term impacts to recreation and tourism would be limited to the construction period and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including Fort Livingston and areas for recreational fishing.

4.2.3.6 FISHERIES AND AQUACULTURE

Affected Environment

The Terrebonne-Barataria estuary is a nationally important fishery resource that overlaps West Grand Terre. The estuary system ecosystem, encompassing 4.1 million acres of upland forests, swamps, marshes, bayous, bays, and barrier islands, is bound on the west by the Atchafalaya River and bound on the east by the Mississippi River in south Louisiana. Sixteen parishes fall within its boundaries: Ascension, Assumption, Iberville, Jefferson, Lafourche, Plaquemines, Pointe Coupee, St. Charles, St. James, St. John the Baptist, St. Mary, Terrebonne, West Baton Rouge and only small portions of Iberia, St. Martin, and Orleans. A variety of commercially and recreationally important finfish species use the Terrebonne-Barataria estuarine environment, including West Grand Terre, at some or all stages of their life cycles. Estuaries in Louisiana are recognized as among the most productive in the United States (USACE 2004). The Terrebonne-Barataria estuarine system is also known for producing significant amounts of white shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*).

The most common target species for Louisiana commercial fishers are Gulf menhaden (locally known as pogie; processed for fish meal), white and brown shrimp, blue crab (*Callinectes sapidus*), black drum, eastern oyster (farmed and dredged), red snapper, *Procambarus* (a genus of crayfish), yellow fin (*Thunnus albacares*), king mackerel, and blue catfish (*Ictalurus furcatus*) (NMFS 2017). Blue crab landings from the Barataria Basin averaged 8.22 million pounds annually from 2000 to 2013 and ranged from a high of 10.89 million pounds in 2006 to a low of 4.94 million pounds in 2010, the year of the DWH Oil Spill (Bourgeois et al. 2014). The borrow area and overburden disposal area are in state waters approximately 4.6 miles from the island. For this reason, the ichthyofauna can include a seasonal mix of tropical and temperate pelagic species as well as adult representatives of the benthic species encountered in the adjacent estuary.

Environmental Consequences

The West Grand Terre alternative would have short-term, minor adverse impacts to fisheries, but overall it would result in long-term benefits to fisheries and aquaculture. The noise and increased turbidity of surface waters arising from earth-moving activities during project construction could cause short-term, minor adverse impacts to fish species. Construction may temporarily impact West Grand Terre’s function as a fish nursey for estuary-dependent fish species, as a fish nursey for forage species, and as a forage area for transient species. To minimize impacts to fisheries, contractors are required to avoid impacting oyster leases and commercial fisheries during construction activities as stated in the provisions and specifications for the alternative (CPRA 2019b). During construction, some commercial fishers or businesses may be affected because of reduced access; however, these impacts would be temporary and localized and not expected to substantially alter social or economic conditions for commercial fisherman or the industry. Overall, the alternative would provide long-term benefits to fisheries and aquaculture by protecting existing estuarine marshes that provide nursery areas for juvenile finfish, shrimp, and other invertebrates.

4.2.3.7 MARINE TRANSPORTATION

Affected Environment

West Grand Terre Island is easily accessible by boat from Grand Isle, which is located across Barataria Pass to the west. The island is only accessible by boat. Barataria Pass is a deep tidal inlet, managed as part of the BWW for navigation by the USACE. The BWW serves as navigation route connecting the Gulf of Mexico with the interior of the central coast of Louisiana cutting through and providing pathways to natural waters before discharging into Barataria Bay north of Grand Isle. These natural waterways and are not currently used for navigation purposes, but smaller vessels may access portions for recreational opportunities.

Environmental Consequences

Construction and implementation of the West Grand Terre alternative would result in short-term, minor adverse impacts to marine transportation. There would be no long-term adverse impacts to marine transportation. Because of the current marine transportation levels in the area, the alternative is unlikely to impact marine transportation. Dredging and disposal pipelines may cause temporary interference to navigation by blocking sections of the BWW during construction, which would be a short-term minor impact. Furthermore, existing NAVAIDS located within or near work areas may be removed if necessary by the USCG (and/or as directed by the USCG) in advance of dredging operations. This need would be assessed by, and any movement shall be coordinated with, USCG. Construction activities shall not remove, change the place of, obstruct, willfully damage, make fast to, or interfere with any NAVAID (CPRA 2019c). There could be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. The creation of the marsh and borrow area would not result in long-term adverse impacts to marine transportation because it would not impede marine transportation routes.

4.2.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. A view refers to a direct and unobstructed line-of-sight to an on- or off-site aesthetic resource, which may take the form of panoramic viewpoints from particular vantages. Existing views may be obstructed or blocked by modifications to the environment (e.g., grading, landscaping, and building construction).

West Grand Terre Island is uninhabited, and its viewshed is predominantly open water and marsh land, with dense weed and brush vegetation on most land surfaces. There are the remnants of Fort Livingston and former LDWF lab operations which make up approximately 45 acres of land (Hydro-Environmental Technology, Inc. [HET] 2017). As stated above, the buildings that made up the LDWF lab are in various states of disrepair and require demolition, removal, and disposal. Along the eastern portion of the island is an oil and gas facility and electric utility lines that can also be seen. Overall these views can be characterized as a mix of uninhabited natural areas with some development in the form of the LDWF lab, Fort Livingston, and energy infrastructure.

Environmental Consequences

The West Grand Terre alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction and would have long-term benefits to aesthetics and visual resources. Modifications to the existing viewshed may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective.

The West Grand Terre alternative would include construction of back-barrier marsh, beach nourishment, and rock revetment, which are intended to restore the barrier shoreline and provide wetland habitat for plant and animal species.

Fort Livingston affords the only opportunity for the public to access the West Grand Terre beach nourishment area, back-barrier marsh, rock revetment, borrow area, and conveyance corridors (see Figure 3.2-1). Visitors at Fort Livingston would be able to see much of the beach nourishment area, back-barrier marsh, and rock revetment. The public would also be able to see portions of the restoration area, borrow area, and conveyance corridors from the open water surrounding the island and from nearby Grand Isle State Park, which is approximately 1 mile from the south end of West Grand Terre. Vegetation and topography in the West Grand Terre analysis area would allow for long-distance views in most parts of the island and surrounding open water. During construction, short-term, minor adverse impacts to visual resources would result from the presence of construction personnel, equipment, vehicles, and partially completed restoration elements.

After construction, the alternative would result in an improvement to visual resources and aesthetics because the back-barrier marsh and protected beach would create a diversity of natural landscape elements within the viewshed. New habitat is anticipated to attract additional birds and wildlife, thereby benefiting the enjoyment of the area by recreational users and the general public. The creation of the restoration area and marsh would be perceived as a beneficial effect for aesthetics and visual resources and could result in improved viewsheds.

4.2.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

In 2017, HET conducted a Phase I Environmental Site Investigation of the West Grand Terre for LDWF that included approximately 80 acres of land consisting of remnants of Fort Livingston and the former LDWF Lab, open marsh areas, access canals, and open waterways (HET 2017). The buildings that made up the LDWF Lab are in various states of disrepair and require demolition, removal, and disposal.

The HET report found that the property contains several structures that are uninhabitable and abandoned, and waters from the Gulf of Mexico were observed under or adjacent to several of the structures. Suspected asbestos containing materials (ACM) were observed within construction materials located on-site. However, an official asbestos inspection of building materials for suspect ACMs was not conducted during this investigation. The investigation also found that there were no vent pipes, fill valves, or other evidence indicative of an underground storage tank (UST) located on the property. Potential concerns included the abandoned aboveground storage tanks (ASTs) on-site and the suspect ACMs observed in the building materials; however, no recognized environmental conditions (RECs) were identified in connection with the property. The report recommended that ASTs should be evaluated prior to future use or removal (HET 2017).

In addition, three hazardous, toxic, and radioactive waste (HTRW) studies were previously conducted on West Grand Terre. The 2001 report prepared by G.E.C., Inc. was a broad-scale project, broken down into six project areas that covered the entire Barataria Basin. Project area II, Grand Terre, included West Grand Terre Island. Based on the site reconnaissance, aerial reconnaissance, records review, land use data, and best engineering judgment, it was G.E.C's professional opinion that the relative risk of 1) an encounter with HTRW in amounts warranting the intervention of health and safety upgrades to levels of personal protective equipment great than Level D (as specified in CFR 1910.120) or 2) actions associated with environmental regulations pertaining to the handling, storage, disposal, or ownership of contaminated sediments is low (G.E.C. 2001).

A separate Phase I Environmental Site Assessment was done at West Grand Terre in 2018 (Providence 2018a). The 2018 Phase I Environmental Site Assessment revealed no evidence of REC in connection with the property (Providence 2018b). Specialized knowledge of beach and overspray areas of West Grand Terre Island being impacted with oil from the DWH Oil Spill is considered a historical REC based on sediment testing completed in March 2018 (Providence 2018b), because concentrations were within regulatory limits. The 2018 Phase I Environmental Site Assessment found that lead-based paints and ACM may be present within interiors and exteriors of the abandoned LDWF Lab structures on the western portion of the property based on the age of the structures. Asbestos sheeting is also suspected to be present in the levees of the LDWF research ponds. The 2018 Phase I Environmental Site Assessment stated that lead-based paints and ACM should be properly managed during demolition, as applicable. Also, the ASTs, septic systems, mechanical debris, used tires, creosote-treated poles, and other household trash and debris at the property should be managed in accordance with applicable LDEQ regulations as part of demolition (Providence 2018a).

In August 2018, soil samples were collected from the wrack line of West Grand Terre Island and offshore sediment samples were collected from the planned borrow site in Grand Terre to determine contaminant levels within the sediments. Sediment samples were compared to LDEQ Risk Evaluation/Corrective Action Program (RECAP) Limiting Screening Standards based on non-industrial land use and EPA's Sediment Benchmarks for Aquatic Life in Response to the DWH Oil Spill. Both soil samples were below their respective thresholds of RECAP Limiting Screening Standards and combined toxicity totals. Based on these results, borrow material is considered suitable for placement on the island, and onshore locations tested are protective based on intended future use (Providence 2018b).

FLOOD AND SHORELINE PROTECTION

West Grand Terre Island has experienced persistent degradation and erosion for more than a century. Shoreline rate changes were developed using historic and recent shoreline positions to identify the following five shoreline change rates for West Grand Terre: historical (1884–1996), short term including Katrina (1996–2006), short term post-Katrina (2006–2017), near term (1996–2017), and overall (1884–2017) (CEC 2018a). Coastal restoration projects have previously been undertaken on West Grand Terre Island by the USACE through the beneficial use of sediment dredged from the BWW in 1996, 1998, 2002, 2006, 2010, and 2017 (USACE n.d.). According to Jefferson Parish, sea levels are projected to rise from 1.52 to 2.73 feet above current levels, and in the next 50 years, the parish could lose 1,125 square miles (42%) of its current footprint (Jefferson Parish 2018).

West Grand Terre Island and its neighboring islands are aligned in an east–west arc and are susceptible to both extratropical frontal storms and tropical storms. The former are primarily winter events, with winds from the south, whereas the latter occurs in the warmer months and wind directions are quite variable, depending on the storm track. The Louisiana coast feels the impact of a tropical storm or hurricane on average every 1.2 years, with actual landfall on average every 2.8 years (Roth n.d.). Regardless, the shallow nature of the sea floor approaching the islands facilitates storm surge flooding of coastal areas, which increases beach erosion and island washover. As such storms approach or pass by the coastline, the counterclockwise (cyclonic) wind circulation can drive waves and surges that can impact both the Gulf-facing and back-barrier shorelines. In addition to storm surge flooding, the post-storm retreat can erode tidal inlet shores and exacerbate breach formation. While the borrow area and overburden disposal area are completely submerged, they are also susceptible to storm-related sediment transport.

Environmental Consequences

There may be short-term minor adverse impacts to public health and safety from the West Grand Terre alternative; however, no long-term adverse impacts to public health and safety would result from the alternative. Impacts to public health and safety may occur during construction from the potential increase in small boat traffic (construction related) in the area, and appropriate safety measures would be employed to ensure water-related accidents and conflicts are minimized. Potential exists for accidental spills and releases of hazardous or toxic wastes. As discussed above, soil and sediment samples were tested and found suitable for use as borrow material and presented no risks to public health and safety (Providence 2018b). Construction projects involving the use of boats and barges and associated equipment could cause oil, fuel, or other hazardous material spills in surface waters, resulting in short-term, minor adverse impacts. Construction contractors are required to implement BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, to prevent oil, fuel, or other hazardous substances from entering the air or water, and they are required to have a spill contingency plan for hazardous, toxic, or petroleum products in place, to be implemented in the unlikely event of an occurrence.

Before construction of the alternative, portions of the abandoned LDWF lab would be removed. The Phase I Environmental Site Assessments identified potential concerns including abandoned ASTs on-site and the suspect ACMs observed in the building materials; but did not find RECs in connection with the property. In accordance with the Phase I Environmental Site Assessment finding, suspected ACMs should be confirmed prior to conducting any demolition or renovation activities on site. The ASTs should be evaluated prior to future use or removal. If encountered during demolition, lead-based paints and ACMs should be properly managed by the construction contractor according to applicable health and safety guidelines.

BMPs in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on-site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. No adverse effects to public health and safety are expected as a result of the alternative. Outreach with recreational users of the site would also be used to inform the public of the bathymetry and topography of the constructed marsh and the protective hard structure breakwater that would result from the alternative. Impacts to public safety would be minor and short-term, occurring only during the construction period.

FLOOD AND SHORELINE PROTECTION

No short-term adverse impacts to flood and shoreline protection during construction of the alternative would occur. The alternative would result in long-term benefits to flood and shoreline protection. The alternative would result in the protection of 8,500 linear feet of shoreline along Barataria Pass and

Barataria Bay on the western side of West Grand Terre Island. This would be accomplished through the construction of approximately 195 acres of beach and dune habitat. In addition, an extension of the beach and dune habitat along the Gulf-front shoreline to the eastern end of the West Grand Terre Island would provide flood and shoreline protection of approximately 56 acres spanning 5,600 feet of shoreline. This shoreline protection would both help prevent shoreline degradation and erosion and serve as a buffer to reduce the force and effects of wave action, saltwater intrusion, storm surge, and tidal currents. This could result in a decreased risk of potential hazards (e.g., decreased likelihood of storm surge) to visitors, residents, and workers from increased shoreline integrity, which would be temporary and localized. The wetland restoration would also provide benefits to coastal populations and infrastructure through improved flood and shoreline protection, thereby improving coastal resiliency and providing a long-term beneficial impact to flood and shoreline protection.

4.3 Golden Triangle Marsh Creation Alternative

4.3.1 Physical Resources

4.3.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The Golden Triangle alternative is in Orleans Parish and St. Bernard Parish, Louisiana, in the eastern portion of the Golden Triangle Marsh, a narrow band of brackish marsh directly east of New Orleans. The marsh, which is located between Lake Borgne and the confluence of the MRGO and the GIWW, is part of the Deltaic Coastal Marshes and Barrier Islands ecoregion of Louisiana (Daigle et al. 2006) within the Pontchartrain Basin. The northern portion of the marsh falls within the Bayou Sauvage NWR, which is one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018). The Golden Triangle alternative is accessible only by boat and includes undeveloped coastal land, marshland, and intertidal and subtidal wetlands. The other features of the alternative, including conveyance and access corridors and a borrow area, extend southeast off the MCAs into Lake Borgne, also crossing into St. Bernard Parish.

The Golden Triangle MCAs are relatively flat areas, with elevations ranging from 1.01 feet above sea level to 0.25 feet below sea level (referenced to NAVD88), underlain by marsh deposits from the Holocene age, consisting of very soft to soft clay with varying silt and sand contents. Underlying the layer of Holocene clay is a layer of Pleistocene clay and sandy clay deposits (GeoEngineers 2018). Surface soils in the MCAs are part of the Clovelly series and Lafitte series (NRCS 2019), which support marsh vegetation and wildlife habitat (Matthews 1982). Clovelly muck, which is part of the Clovelly series, is found throughout the alternative and consists of very deep, very poorly drained, very slowly permeable soils typical of broad coastal marshes that are continuously flooded with brackish water. Lafitte muck, which is part of the Lafitte series, is also found throughout the MCAs and consists of very deep, very poorly drained, rapidly permeable organic soils found in intermediate and brackish marshes of Louisiana's coastal areas. Substrates in the MCAs consist of very soft peat and organic clay to a depth of approximately 15 feet below the mudline. From depths of 15 to 60 feet are very soft to soft Holocene clay with varying silt and sand contents that are underlined by soft to very soft clay, medium to stiff Pleistocene clay, and sandy clay deposits. Borrow area sediments are made of very soft clays and silts with little sands.

The coastal regions of Louisiana, including the MCAs, have experienced significant elevation and land loss due to subsidence and sea level rise. Rates of subsidence for the Orleans Landbridge, which is a stretch of land and marsh north of the Golden Triangle alternative between Lake Borgne and Lake Pontchartrain, were estimated to range between 0.002 and 0.009 m per year (CPRA 2012).

Environmental Consequences

The Golden Triangle alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

The use of onshore staging areas and construction activities on the shoreline of Lake Borgne would disturb substrate materials. Offshore activities, including anchoring of vessels and the use of equipment on the shoreline and on marsh buggies and other vessels to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The dredging depth in the borrow area would be -24.0 feet NAV88, and the maximum excavation depth to accommodate the booster pump within the borrow area would be -10.0 feet NAV88.

The creation of the MCAs, containment dike areas, and overburden disposal area would result in localized compaction and sediment disturbance that would permanently alter geologic characteristics and substrates, including sediment dynamics, at a localized level. The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to geologic changes.

Centrally locating the staging area between the three MCAs, rather than creating multiple staging areas, and locating the sidecast disposal area in a previously disturbed location would reduce disturbance that would lead to disruption or changes in geology and substrates from erosion and compaction. Containment dikes would be built using in-situ material within boundaries of the marsh fill areas, which would be refilled during construction of the MCAs, thereby reducing the extent of areas excavated or dredged. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing erosion during and after construction.

Once completed, the MCAs would provide long-term benefits to geology and substrates. The depositions of sediments in the MCAs would raise substrate elevations affected by subsidence and sea level rise, thereby helping to increase the resiliency of the coastal wetlands. Restoration of the marshes would increase protection of the coastline from sea level rise and help reduce shoreline erosion. The long-term benefits to geology and substrates from implementation of the alternative help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.3.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

BASINS AND IMPAIRED WATERBODIES

The Golden Triangle alternative is in the Pontchartrain Basin, which covers portions of southeast Louisiana and southwest Mississippi. The topography of the Pontchartrain Basin is marked by rolling hills and coastal wetlands with elevations ranging from 300 feet above sea level to 10 feet below sea level (LDWF 2005b). The northern portion of the basin includes freshwater lakes, whereas lakes in the southern portion of the basin, Lakes Maurepas, Pontchartrain, and Borgne, form a shallow brackish basin. This brackish basin receives freshwater inputs from several rivers and regional drainage and diversion canals, with saltwater inputs from the Gulf of Mexico that travel through the Mississippi Sound, MRGO, Chef Pass, and Rigolets Pass (LDWF 2005b). The flows in the basin have been influenced by a number of sources, including channelization, construction and operation of drainage and diversion systems, mining practices, and operation of dams or reservoirs (LDWF 2005b).

There are no fresh surface waterbodies in the Golden Triangle alternative. The waters around the MCAs and the western terminus of the conveyance corridor would include the estuarine portion of the Bayou Bienvenue River from MRGO to Bayou Villere (subsegment 042004) (LDEQ 2004). Water levels in the MCAs vary, with water bottoms typically being less than 1 foot below the ground surface (NAVD88). The conveyance corridor, borrow area, and the southern portion of the access corridor are in Lake Borgne (subsegment 042001), which is an estuarine coastal lagoon, with depths near the alternative ranging from 6 to 10 feet. The northern portion of the access corridor is in the Bayou Sauvage, which is an estuary that includes a hurricane protection levee to Chef Menteur Pass (subsegment 041702). There are no aquifers underlying the MCAs, and the closest aquifer is the Mississippi River alluvial aquifer, approximately 1 mile north of the MCAs and approximately 0.2 mile north of the most northern extent of the proposed access corridor.

The water quality of the Pontchartrain Basin is heavily influenced by saline water inputs through tidal exchanges (USGS 2002). The MCAs have experienced changes in salinities and hydrology from loss of wetlands, freshwater inputs (primarily rainfall), and saline inputs from Lake Borgne, which is heavily influenced by saltwater inputs from the Mississippi Sound and by freshwater inputs from the Pearl River (USGS 2002). Bayou Bienvenue (subsegment 042004), which surrounds the MCAs, fully supports PCR, SCR, and FWP. However, this subsegment does not fully support OYS because of the presence of fecal coliform from wildlife and other waterfowl sources, and it was placed on 2018 303(d) List of Impaired Waterbodies (LDEQ 2019a). Lake Borgne fully supports PCR, SCR, FWP, and OP, and the Bayou Sauvage segment crossed by the alternative fully supports PCR, SCR, and FWP.

Water quality measurements were collected in 2018 from 38 locations in and around the borrow area in Lake Borgne at depths of 1 to 10 feet (APTIM 2018a). These measurements revealed salinity concentrations in Lake Borgne ranging from 2.79 to 2.85 practical salinity unit, or parts per thousand (ppt), which fall within the average salinity for brackish surface water, which is defined by state water quality standards as 2 parts per thousand (ppt) or greater and less than 10 ppt (LDEQ 2017). Dissolved oxygen concentrations in Lake Borgne ranged by depth from 7.34 to 6.84 milligrams per liter, which exceed estuarine water quality standards of 4 milligrams per liter. Turbidity levels in the lake, which range in depth from 5.72 to 8.91 FNU, are well below the maximum guideline level for estuarine lakes, as defined by state water quality standards, of 50 NTU.

WETLANDS AND FLOODPLAINS

There is more than 480,000 acres of wetlands in Pontchartrain Basin, including brackish marshes throughout the Golden Triangle MCAs and the banks of Lake Borgne surrounding the alternative (CWPPRA 2019; LDWF et al. 2013). These wetlands serve as major sources of carbon sequestration. CWPPRA (2019) estimates more than 66,000 acres of marsh in the basin has been converted to open water since 1932. As described for the West Grand Terre alternative, wetlands in the region have been deteriorating because of subsidence and sea level rise. Levees along the Mississippi River limit freshwater, sediment, and nutrient inputs to the basin, and the construction of the MRGO and other canals has led to increased subsidence rates from heightened salinity, thereby increasing stress to wetlands in the region. Wetlands have also deteriorated because of erosion from vessel traffic in the MRGO channel, which results in waves along the channel (CWPPRA 2019). It is estimated that erosion has caused the direct loss of more than 1,700 acres of marsh since 1968 (CWPPRA 2019).

The Golden Triangle alternative is located within SFHAs subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone). The MCAs, areas north of the conveyance corridor and borrow area, and the access corridor are within a SFHA Zone VE, with BFEs ranging from 17 to 24 feet (FEMA 2016).

Coastal brackish marshes in the MCAs are irregularly tidally flooded. The construction of channels, including the MRGO, have impacted the area’s hydrology and likely contributed to the severity of flooding in the area, including flooding in New Orleans during Hurricane Katrina in 2005 (van Heerden et al. 2009). As part of the Hurricane and Storm Damage Risk Reduction System, three permanent canal closures and pumps, 107 miles of levees/floodwalls, 1,400 acres of levee turn maintenance areas, 200 flood gates, and six navigable floodgates have been constructed by Orleans Levee District (Southeast Louisiana Flood Protection Authority – East 2017a). In St. Bernard Parish, 57 miles of levees/floodwalls, 1,400 acres of levee turn maintenance areas, 32 land-based flood gates, two navigable floodgates, 56 miles of drainage canals, and eight drainage pump stations have also been constructed as part of the system. The levees/floodwalls in these areas include a 1.8-mile-long Lake Borgne Surge Barrier designed to prevent the inundation of New Orleans metropolitan areas in the event of a 100-year flood (or storm surge) in Lake Borgne, the MRGO, and the GIWW (Southeast Louisiana Flood Protection Authority – East 2017b).

Environmental Consequences

Construction and implementation of the Golden Triangle alternative would result in short-term, minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

The use of a staging area on the shoreline of Lake Borgne would disturb soils and lead to erosion. Anchoring and other offshore activities, including the use of equipment near the shoreline and on pontoons to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration.

The disturbance of soils and sediments and increases in erosion during construction could lead to increased turbidity and sedimentation in nearby wetlands and waterbodies, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into wetlands or waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards. Sand fencing and vegetation would be installed in the dune and MCAs to reduce erosion.

Centrally locating the staging area between the three MCAs, rather than creating multiple staging areas, and constructing dikes along the perimeters of the MCAs to contain marsh creation materials would reduce disturbance that would contribute to erosion and sedimentation. The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize adverse impacts on hydrology, water quality, and wetlands by minimizing sediment and pollutant loads into waterbodies and controlling stormwater runoff. Therefore, construction and implementation of the Golden Triangle alternative would result in short-term and minor adverse impacts to hydrology, water quality, and wetlands.

Once completed, the MCAs would provide long-term benefits to hydrology, water quality, and wetlands. The creation of marshes would help coastal wetlands reconnect to tidal flooding, which would restore the natural hydrology in and around the localized the marsh areas. Restoring the hydrology would support the reestablishment of natural estuarine salinity gradients and would help maintain and improve coastal water quality, thereby benefiting coastal habitats and resources in the Golden Triangle Marsh area. These long-term benefits to hydrology and water quality from implementation of the alternative would help restore and support natural hydrologic processes and improving overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.3.1.3 AIR QUALITY

Affected Environment

The Golden Triangle alternative is uninhabited and only accessible by boat. As a result, air pollution sources would be limited to infrequent boat traffic and small oil and gas processing facilities. The closest major sources of air pollution come from vessel and boat traffic along the GIWW and the MRGO, which serve as major shipping channels, ports along shipping routes, and urban-industrial areas in and around New Orleans. As described for the West Grand Terre alternative (see Section 4.2.1.3), other sources of air pollution come from the release of soil-sequestered greenhouse gases through wetland degradation.

There are two LDEQ air quality monitoring stations in the Orleans Parish that are both located in New Orleans: the City Park station (EPA AQS 220710012) and the I-610 New Orleans Near Road station (EPA AQS 220710021) (LDEQ 2019b). There are also two stations in St. Bernard Parish in the cities of Chalmette (EPA AQS 220870007) and Meraux (EPA AQS 220870004). From 1995 through July 2019, the Orleans Parish has been listed as an attainment area for all NAAQS (EPA 2019). St. Bernard Parish has been listed as nonattainment area for sulfur dioxide from 2013 through July 2019.

Environmental Consequences

Short-term, minor adverse impacts to air quality would result from construction of the alternative. In-water and onshore construction activities during implementation of the Golden Triangle alternative would require the use of vehicles, machinery, and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.3.1.4 NOISE

Affected Environment

Because the Golden Triangle alternative marsh area is uninhabited and accessible only by boat, noise is limited to activities associated with oil and gas wells, the pipeline crossing Lake Borgne, and transient vessel traffic. Noise from distant urban areas and other oil and gas production facilities likely contribute negligible noise impacts to the MCAs and conveyance corridor. The borrow area and access corridor are closer to major noise-producing sources including vessel and boat traffic and port activities in GIWW and MRGO. In addition to these noise sources, the northern portion of the access corridor is within 1 mile of noise-producing developed areas, including a rail line, Chef Menteur Highway, and industrial and residential areas. However, this area is sparsely populated, and noise generated by these urban areas is negligible.

Environmental Consequences

The Golden Triangle alternative would result in short-term minor adverse noise impacts. Construction of the Golden Triangle alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials. These noise impacts would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. The alternative would not result in long-term noise impacts.

4.3.2 Biological Resources

4.3.2.1 HABITATS

Affected Environment

The Golden Triangle alternative is in the St. Bernard Delta of the Mississippi River, which is geographically located at the southern end of the Lower Mississippi River Ecosystem (LMRE). The LMRE includes the deltaic plain and associated marshes and swamps created by the meanderings of the Mississippi River and its distributaries. The alternative is located within the Gulf Coast Prairies and Marshes ecoregion of the LMRE, occupying the coastal zone of the Gulf of Mexico and defined by coastal prairie and marsh communities (Daigle et al. 2006). Louisiana's coastal marsh areas comprise salt, brackish, intermediate, and fresh marsh habitat types.

The alternative falls within and directly adjacent to the Bayou Sauvage NWR on the shoreline of Lake Borgne, within the city limits of New Orleans. The NWR was established in 1990 to provide wintering habitat for migratory birds and waterfowl (USFWS 2009). The NWR includes fresh and brackish marshes and coastal hardwood forest and serves as valuable habitat for wildlife, fish, and shellfish, and contains one of the last remaining marsh areas adjacent to Lake Pontchartrain and Lake Borgne. Lake Pontchartrain and adjacent lakes in Louisiana form one of the larger estuaries in the Gulf Coast region. The marshes along Lakes Pontchartrain and Borgne serve as estuarine nurseries for various fish species, crabs, and shrimp.

Specifically, the proposed marsh restoration portion of the alternative consists of brackish marsh, which is irregularly tidally flooded and is usually found between salt marsh and intermediate marsh. Brackish marshes support salt-tolerant vegetation and typically have higher plant diversity and soil organic matter than salt marshes (LDWF 2019d). Brackish marshes are dominated by saltmeadow-marshhay cordgrass, followed by smooth cordgrass. Smooth cordgrass generally dominates the edges of marsh ponds (USFWS 2019b). Other species may include saltmarsh lythrum (*Lythrum lineare*), sturdy bulrush (*Bolboschoenus robustus*), and coastal saltgrass (*Distichlis spicata*). Common reed (*Phragmites australis*), a nonnative species, has also been recorded near the alternative at monitoring station CRMA3650 (CRPA 2019a). Black mangrove exists in a few areas, and some live oak (*Quercus virginiana*) can be found along natural levees. Observations from site visits suggest the alternative would support a brackish marsh community dominated by smooth cordgrass and saltmeadow-marshhay cordgrass. SAV was observed in shallow water areas throughout the marsh restoration portion of the alternative (APTIM 2018a).

The alternative's borrow area, most of the pipeline corridor, and the access corridor generally consist of soft-bottom marine benthic habitats. The borrow area has a substrate consisting of a mud/sand/silt matrix and water depths range from 2 to 3 m (6–10 feet). Surveys conducted in the borrow, overburden disposal, and conveyance areas confirmed that there are no SAV present (APTIM 2018b). The borrow area and a portion of the pipeline corridor are within critical habitat for Gulf sturgeon designated under the ESA (see Section 4.3.2.4).

Environmental Consequences

Minor, short-term adverse effects to the marsh and estuarine habitats of the Golden Triangle alternative from construction could occur during fill activities. These adverse impacts include increased potential for erosion and sedimentation and temporary habitat loss related to ground disturbance and placement of sediment in marsh habitats. In estuarine environments, adverse impacts include a localized and short-term decrease in available dissolved oxygen and an increase in turbidity, temperature, and biological oxygen demand during sediment removal and placement.

Creation and/or nourishment of approximately 774 acres of brackish marsh habitat would have short-term, minor adverse impacts on existing habitat near the fill area. The marsh fill area includes approximately 694 acres of degraded marsh and approximately 80 acres of intact marsh habitat. The placement of dredged sediment within the marsh fill area would convert areas of open shallow water and degraded marsh to approximately 494 acres of intertidal and 263 acres of subtidal brackish marsh. This may increase turbidity in aquatic habitats located near the marsh fill area in the short term. Sediment placement may result in the loss of individual plants (including SAV) and habitat within the marsh fill footprint; however, these impacts would be limited to localized areas, and similar habitat is available directly adjacent to the disturbance area. Post-construction, the newly created marsh area would be revegetated with native vegetation; therefore, the disturbance of existing habitat would be short term. In the long term, an increase in quality and quantity of brackish marsh habitat would be beneficial for estuarine and marine ecosystems because healthy marshes provide dissolved organic compounds and detritus that would provide food and energy resources for both the planktonic and benthic communities of estuarine and nearshore habitats.

Construction of approximately 44,000 linear feet of containment dike would result in minor, short-term impacts to estuarine habitats. Similar to the impacts discussed above for the marsh fill activities, an increase in turbidity of adjacent aquatic environments from ground-disturbing activities (such as digging and placement of sediment and pile driving) may occur in the short term. Post-construction, the containment dikes would be revegetated with native vegetation; therefore, the disturbance of existing habitat would be short term. Minor, long-term beneficial effects from placement of sheet piling and containment dikes could result in a change in elevation that may affect the vegetation community that reestablishes on the containment dike.

As noted above, no SAV are present within the borrow area, pipeline corridor, or navigation channel; therefore, no adverse impacts to SAV are anticipated. Minor, short-term impacts associated with the pipeline corridor would result from laying sediment pipeline from the borrow area to the marsh fill areas. These adverse impacts include disturbance of benthic habitat and increased turbidity of estuarine environments and would be minor and short-term. In the borrow site, minor to moderate short-term adverse impacts to benthic resources would occur as the overburden is removed from the borrow area. Long-term, benthic resources in disturbed areas would reestablish from adjacent undisturbed areas. Following fill operations, the pipeline corridor and borrow areas would return to ambient conditions and be re-colonized by benthic populations within 1 to 3 years (Greene 2002) following construction.

Impacts associated with the potential dredging of the navigation channel would be similar to those described for the borrow areas.

Ground-disturbing activities could result in the spread of invasive species near the MCAs of the alternative, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring, and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.3.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. Continued land loss in and around the alternative has changed the landscape and use of habitat over time (USFWS 2009). In particular, Hurricane Katrina affected available habitat for terrestrial species. Bayou Sauvage NWR is directly adjacent to the proposed marsh creation portion of the alternative. Because of the proximity of the NWR to the alternative, it is assumed that wildlife species described as potentially occurring in the NWR may also be present within similar habitats in the alternative.

Mammals common to the Bayou Sauvage NWR and likely to use the Golden Triangle alternative are white-tailed deer (*Odocoileus virginianus*), squirrels, otter (*Lutra canadensis*), raccoon, feral hog (*Sus scrofa*), nutria, and mink (*Mustela vison*). Large numbers of American alligators and turtles, such as the diamondback terrapin, existed on the refuge; however, these species have experienced population declines as a result of habitat loss related to Hurricane Katrina (USFWS 2009).

The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37. The Bayou Sauvage NWR provides habitat for more than 340 species of birds and is recognized as an important area for migratory waterfowl and other waterbirds that depend on shallow water with submerged and emergent herbaceous aquatic plants. The position of the NWR as an oasis in the midst of development and open water also makes it an important resting and feeding area for migratory songbirds. Wading birds use the abundant forage resources in the shallow water habitats; however, because trees and other vertical features are rare, the alternative provides limited nesting habitat. The emergent marsh habitat supports marsh birds; these species need a mosaic of open, shallow water with emergent vegetation. Secretive marsh bird surveys in the Bayou Sauvage NWR prior to 2005 revealed large numbers of nesting king and clapper rails (*Rallus elegans* and *R. crepitans*), purple and common gallinules (*Porphyrio martinica* and *Gallinula galeata*), and least bittern (*Ixobrychus exilis*); these numbers have declined since Hurricane Katrina. A number of gull and tern species use the Bayou Sauvage NWR for loafing and feeding. Other waterbirds of management concern that feed in the area are the brown pelican, which is observed year-round but does not breed on the refuge, and the American coot (*Fulica americana*) and American white pelican (*Pelecanus erythrorhynchos*), which winter in the area (USFWS 2009).

Environmental Consequences

Minor, short-term adverse impacts from construction may occur to wildlife individuals during marsh fill activities and pile driving related to human noise and disturbance and habitat change or loss. Short-term, minor adverse impacts to wildlife individuals could occur during ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Other short-term, minor adverse impacts include the loss of habitat during construction in the short term. However, any such impacts would be localized and temporary, and impacted individuals of most wildlife would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the marsh fill activities. The restoration of additional highly productive marsh habitat is anticipated to be largely ecologically beneficial. The improvement in quality of habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species have the potential to occur within the alternative. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential impacts to resident and migratory birds. Therefore, long-term adverse effects to these species would not be anticipated. Minor, short-term adverse impacts to foraging birds may occur if displaced during construction; however, marsh areas are available outside of the alternative and would provide foraging habitat. Long-term benefits include improved habitat diversity and longevity of the marsh as a foraging resource and an increase in the quantity and quality of the foraging habitat, in addition to improvement of nesting habitat for colonial waterbirds once vegetation becomes established. Potential minor, short-term adverse effects from the dredging activities would be limited to disturbance to birds in nearshore waters from increased vessel traffic. However, such impacts would be localized and temporary, and impacted individuals would move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.3.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the marsh, and the borrow, overburden disposal, and conveyance areas. The wetlands, flats, and subtidal habitat around the Golden Triangle Marsh provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Brackish marsh habitat supports benthic and epiphytic algae and is important for estuarine larval forms of marine organisms including shrimp, crabs, and fish species such as Gulf menhaden (LDWF 2005a).

The borrow area contains a mud/sand/silt matrix, and water depths range from 2 to 3 m (6 to 10 feet). Benthic organisms would be similar to those described for the borrow and conveyance areas of the West Grand Terre alternative (see Section 4.2.2.3). Adjacent to the alternative, Lake Borgne provides habitat for bivalve species including the Gulf wedge clam (*Rangia cuneata*) and eastern oyster. Oyster leases are present along the edge of Lake Borgne directly adjacent to portions of the MCAs and bisected by a conveyance area (LDWF 2019b).

Macroinvertebrate samples were collected from Lake Borgne in 2018, and seven taxa were identified. The dominant species sampled was the Gulf wedge clam, followed by two gastropod mollusks *Texadina sphinctostoma* and *Probythinella protera* (Wood Environment and Infrastructure Solutions 2018). An occasional polychaete worm (*Mediomastu*s sp. or *Hermundura tricuspis*) or aquatic insect (*Collembola* sp.) was found in a few of the samples. No crustaceans, echinoderms, or other phyla were collected in any of the samples. The sampling demonstrated a fairly low species richness. A benthic survey was performed by USACE Engineer Research Development Center to assess potential benthic species assemblages within Lake Borgne and Biloxi Marsh (USACE 2012). The benthic species assemblage was dominated by polychaetes (62%), bivalves (14%), and amphipods (11%). The most abundant species, the polychaete *Mediomastus ambiseta*, accounted for more than 28% of all animals collected. The most abundant bivalve mollusks were *Macoma mitchelli*, *Mulinia lateralis*, and *Mulinia pontchartrainensis*. Amphipods were dominated by *Ampelisca abdita*, *Ameroculodes* sp., and *Cerapus benthophilus*. Other abundant species included the gastropod *Acetocina canaliculata*, two unidentified species of nemerteans, and the oligochaete *Tubificoides* sp. This assemblage is typical of soft bottom, mesohaline communities throughout the northern Gulf of Mexico.

The alternative is considered saltwater as are the areas to the north (Lakes Maurepas and Lake Pontchartrain) and the areas to the south and east (Lake Borgne and the Mississippi Sound). However, the Golden Triangle alternative and surrounding habitat is better described as estuarine; therefore, both freshwater and saltwater fish species may use the area. In Lake Borgne, 29 species of freshwater and estuarine-marine fish have been documented (Davis et al. 1970). These include bay anchovy, striped anchovy, channel catfish (*Ictalurus punctatus*), Atlantic croaker, spot, sand seatrout, southern puffer (*Sphoeroides nephelus*), Gulf menhaden, and gafftopsail catfish. Saltwater species noted as common near Lake Borgne and Lake Pontchartrain are southern flounder, red drum, spotted seatrout, crabs, and shrimp (USFWS 2009).

The alternative is in EFH Ecoregion 3 (East Louisiana, Mississippi, and Alabama), which extends from Pensacola Bay to the Mississippi Delta and contains a variety of estuarine habitat types designated as EFH (e.g., open water, emergent saline and brackish marsh, submerged aquatic grass beds, oyster reef, sand/shell bottom, and mud/soft bottom). In the alternative, EFH has been designated for red drum, reef fishes (gray [mangrove] snapper and lane snapper), shrimps (brown and white shrimp), sharks (Atlantic sharpnose shark, black-tipped shark, bull shark, finetooth shark, and scalloped hammerhead shark), and one coastal migratory pelagic (Spanish mackerel) (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.3-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

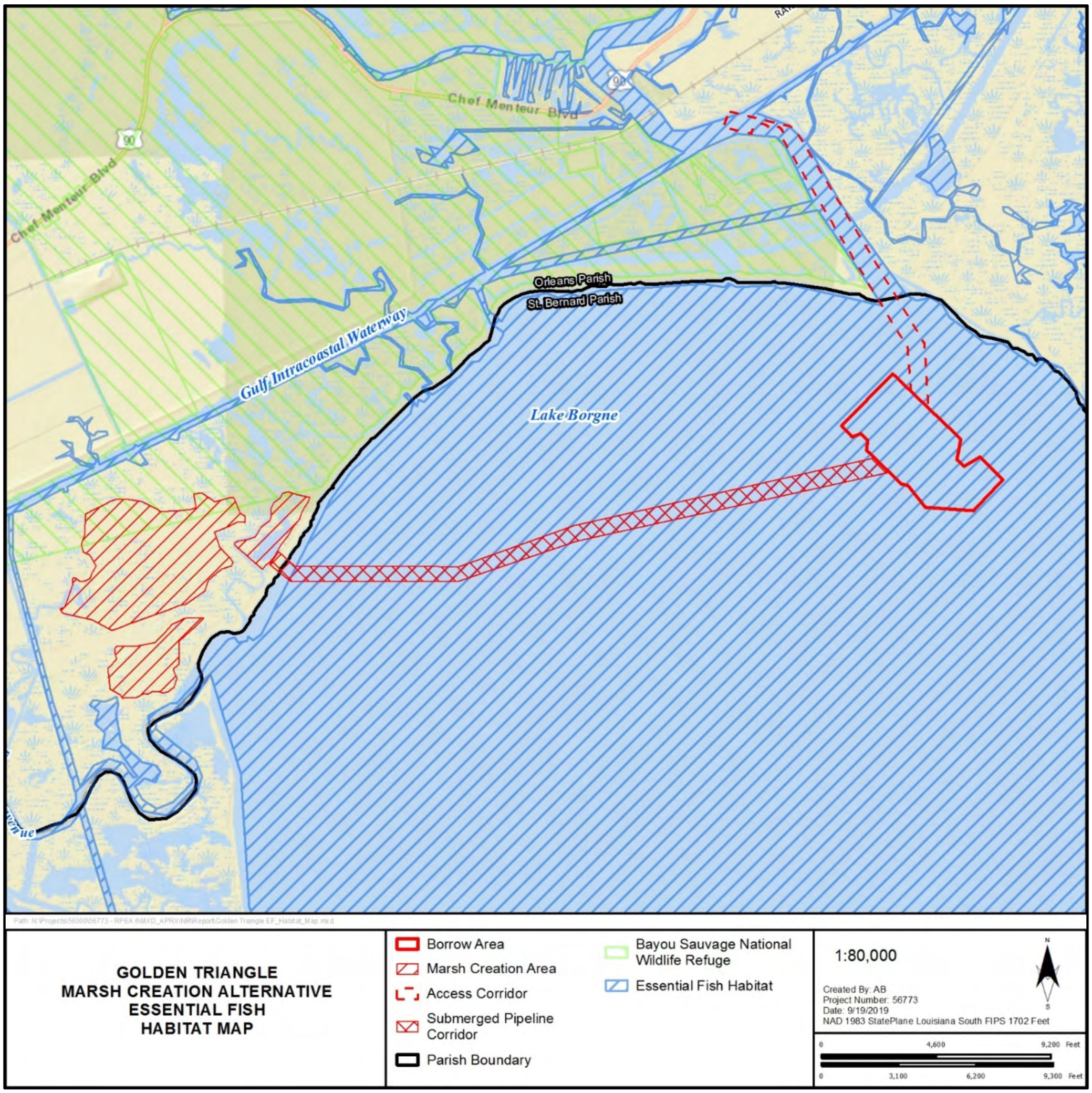

Figure 4.3-1. Essential fish habitat within the Golden Triangle alternative.

Environmental Consequences

The Golden Triangle alternative was designed to avoid oyster lease locations during construction activities (i.e., dredging and marsh creation) and during placement of construction features (i.e., submerged pipeline and booster pump locations). Therefore, no direct adverse impacts to existing oyster leases in the alternative are anticipated. Potential indirect adverse impacts would be similar to those described below for benthic fauna and fish habitats.

Short-term, minor adverse impacts to benthic habitats during marsh fill activities may occur from the placement of pipelines in the pipeline corridor, dredging of the borrow area, and placement of sediment in the footprint where existing shallow water and intertidal marsh habitats would be covered. Disturbance of sediments during dredging and sediment placement may increase turbidity around these areas, which could affect sensitive benthic habitats such as SAV (Michel et al. 2013) in the short-term; however, SAV was only observed in the marsh fill areas and would not be adversely impacted by installation of the pipeline or dredging of the borrow area. Minor, short-term adverse impacts to any slow-moving or sessile benthic organisms found within the borrow area and intertidal footprints of the marsh restoration sites through removal or burial (as discussed in Section 4.2.2.3), respectively. More mobile benthic species would likely be displaced, whereas other impacts to the benthic fauna would be localized and confined to construction areas. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly. The recovery of abundance, diversity, and evenness relative to reference sites often generally occurs within 1.0 year and achieving community composition similar to undisturbed sites occurs within 2.5 years (Greene 2002; Michel et al. 2013).

During construction, short-term, minor adverse impacts to marine and estuarine species habitats may occur through pile driving, sediment deposition, and increased turbidity. The conversion of shallow open water habitat within degraded marsh habitats to restored intertidal and subtidal marsh could result in long-term, minor adverse impacts to habitat; however, this impact would be offset by the long-term ecological benefits from restoring marsh habitats. Productive marsh habitats support ecological connectivity within the estuarine ecosystem through the movement of animals that use wetlands during their lifecycle to grow and reproduce. Many of the species that use brackish marshes as juveniles later move into deeper waters, where they serve as prey for other species. Overall, marsh restoration would provide long-term benefits for many estuarine and marine species, including fish, shrimp, and shellfish in the form of food, shelter, breeding, and nursery habitat. Marsh restoration would benefit benthic resources by providing increased dissolved organic compounds and detritus that would provide food and energy resources for benthic organisms.

Short-term minor adverse effects to EFH may occur during dredging and fill-related activities (such as pile driving). During these activities, species and their prey species may leave the borrow area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in disturbance of feeding or spawning and other behaviors by some species individuals in the short term. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed restoration of marsh habitat would result in long-term benefits to estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh restoration would also benefit species within the ecosystem by contributing to the aquatic food web and providing a more productive habitat.

4.3.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of Orleans and St. Bernard Parishes. The list of species listed as threatened or endangered within these two parishes is the same as those described for the West Grand Terre alternative and are described in Table 4.2-2. Because the alternative consists of estuarine and brackish marsh habitats and is located far from the nearest barrier island and/or beach habitat, six species included in Table 4.2-2 (Gulf sturgeon; pallid sturgeon; West Indian manatee; and green, loggerhead, and Kemp's Ridley sea turtles) have the potential to be present in or near the alternative (USFWS 2019a). However, because the pallid sturgeon inhabits large freshwater rivers with flowing waters specifically within the main-channel habitats (USFWS 2014) and because the Golden Triangle alternative is in Lake Borgne, the estuarine environments of which lack the characteristics of large riverine main channel habitats, sand bars, and islands preferred by the pallid sturgeon (USFWS 2007), this species is not expected to be present in or near the alternative.

West Indian manatee occurs along the southern Louisiana coast (USFWS 2019a). Manatees feed on submerged vegetation, but mainly forage on marine seagrasses such as turtle grass, manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Habitats suitable to support marine vegetation, which could attract the West Indian manatee, may be present in the alternative. However, West Indian manatee has not been documented in or near the alternative; thus, occurrences of this species is uncommon, and there is a low probability the species would occur in the alternative (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within the alternative.

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending on the life stage of the species and season (NMFS 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). Gulf sturgeon are categorized into spawning populations based on the river system they inhabit. Currently Gulf sturgeon inhabit and spawn in seven river systems, the Pearl River system is the closest to the alternative. The Pearl River empties into the eastern portion of Lake Borgne near the Rigolets. The alternative is located within designated critical habitat for this species in Lake Borgne and Lake Pontchartrain (discussed in more detail below).

Designated critical habitat for Gulf sturgeon is present within the alternative (see Figure 4.3-2). Critical habitat for the Gulf sturgeon was designated in 2003 (USFWS 2007) and is restricted to the eastern half of Lake Pontchartrain and the entirety of Lake Borgne, in the eastern portion of the alternative (see Figure 4.3-2). This critical habitat (Unit 8) (USFWS and NMFS 2003) contains habitat identified as estuarine and marine habitat of the species, and provides juvenile, subadult, and adult feeding, resting, and passage habitat from the Pascagoula and the Pearl River subpopulations. Lake Pontchartrain is thought to provide important wintering habitat for juveniles and subadults (USFWS 2007). Few Gulf sturgeon have been found inhabiting Lake Borgne (USACE 2012).

Elements of the Golden Triangle alternative that would be located within the critical habitat unit include the 78-acre borrow area and the portion of the pipeline corridor within Lake Borgne. Suitable habitat is considered where water is 2 to 4 m deep with at least 80% sand, and the benthic community is dominated by crustaceans and annelids (Fox et al. 2002). As sandier substrates provide higher concentrations of benthic organisms, habitats with substrates consisting of greater than 75% sand are likely more valuable foraging habitat. During the borrow area design stage for the Golden Triangle alternative, surveys were conducted in 2017 and 2018 to characterize the substrate in potential borrow areas to determine potential for Gulf sturgeon habitat. Areas with 75% or greater sand content were determined to be potential foraging habitat (Fox et al. 2002) and were eliminated from consideration for borrow area placement. All the sediment samples collected in the proposed borrow area contained sand composition below the 75% concentration (APTIM 2018a). Generally, sandy habitat is absent from Lake Borgne, although Gulf sturgeon prey also includes amphipods that are closely associated with brackish, muddy habitats that are common across Lake Borgne (USACE 2012). Therefore, it is possible that this species is present within the alternative.

Three species of sea turtles (loggerhead, Kemp's Ridley, and green sea turtles) may be present within the alternative's marine environments. Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for loggerhead, Kemp's Ridley, and green sea turtles, these species are not expected to use terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The loggerhead, green, and Kemp's Ridley sea turtles may be present within the shallow waters of the alternative for feeding because the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe 2016). The loggerhead sea turtle is the most common sea turtle species in Louisiana.

No piping plover critical habitat is in the alternative (USFWS 2001). The closest piping plover critical habitat is CH Unit LA-7, which is approximately 55 miles west of the alternative and includes the Chandeleur Islands and other islands to the south in the Gulf of Mexico.

No bald eagles are known to breed and winter near the alternative.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) uses the southeastern Louisiana salt and brackish marsh habitat within Lake Borgne and Bay Boudreau, Louisiana (Hayes et al. 2019); therefore, this species may be present in and around the alternative.

Environmental Consequences

Activities that may adversely affect manatees present in and around the alternative are construction-related in-water work that would include dredging, pile driving, marsh fill, and placement of pipeline. These activities would result in adverse impacts related to temporary, localized turbidity and construction noise that may result in avoidance behaviors by manatees if present near the alternative's construction area. Other adverse impacts include collision with vessels/barges and entanglement with anchor management and/or dredge systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential adverse impacts to this species. Adherence to the protection measures would help ensure that any manatee present in the alternative would not be adversely affected. Any potential disturbance to the manatee would be intermittent, would be limited to project construction, and would result in temporary displacement as individuals would likely move to another area for foraging or resting purposes. In the long term, an increase in marsh habitat area would be beneficial for healthy vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats, which could contribute to improved conditions for SAV in in and around the alternative.

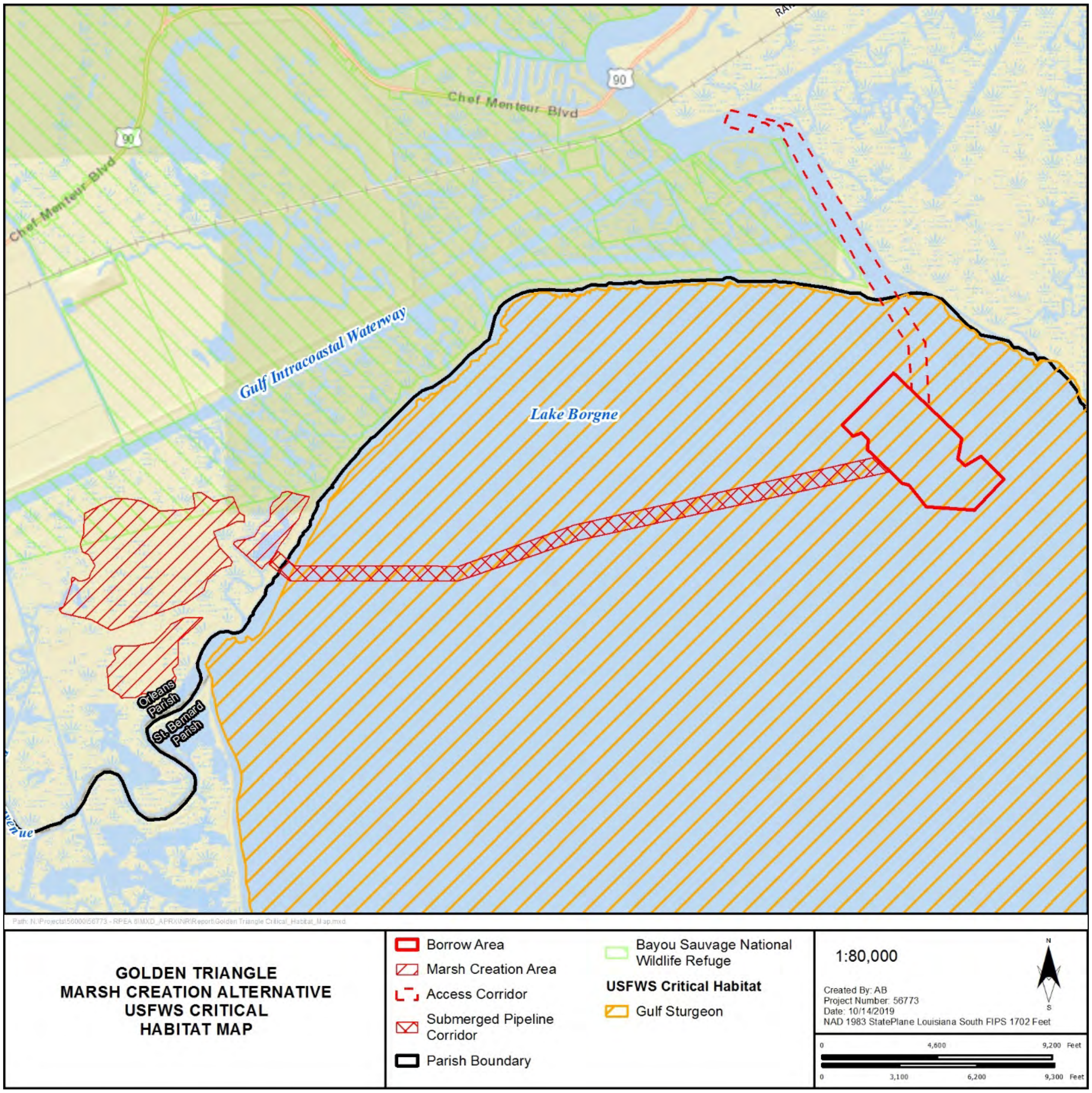

Figure 4.3-2. Critical habitat within Golden Triangle Marsh Creation alternative.

Because the alternative contains estuarine habitat, the Golden Triangle alternative would have the potential to result in adverse impacts to adult and sub-adult Gulf sturgeon while overwintering and foraging. Gulf sturgeon could be adversely impacted by in-water work that would include dredge activities that result in temporary, localized turbidity, decreases in dissolved oxygen, and habitat alteration. Noise related to construction and human activity, such as pile driving, may also disturb Gulf sturgeon. These fish are highly mobile; therefore, individuals disturbed by effects from construction activities would likely move to another area. Other adverse impacts may include potential entrapment or entrainment during dredging and/or entanglement with anchor management systems. Long-term adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated because of the localized and temporary nature of the construction activities and the implementation of the Gulf sturgeon BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS to reduce and avoid potential adverse impacts to this species. The long-term beneficial effects of the Golden Triangle alternative would contribute to improvement of shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem. As a result, the Golden Triangle alternative would contribute to long-term net benefits to biological resources and ecological conditions, which could benefit this species.

Adverse impacts to Gulf sturgeon critical habitat may include disturbance to benthic habitats within Lake Borgne and the loss of potential foraging habitat adjacent to the area of disturbance. The dredging operations could result in temporary degradation of water quality through the release of buried organic matter causing the reductions in dissolved oxygen and sediment suspension resulting in increased turbidity. Additionally, noise associated with construction activities (such as pile driving) could result in the temporary loss of foraging habitats because individuals may avoid suitable habitats in and near the alternative. These effects are not anticipated to result in long-term, adverse impacts to designated critical habitat for Gulf sturgeon because dredging areas are located outside of potential high-value foraging habitat and suitable foraging habitat is available outside of the alternative. As described in the affected environment, Gulf sturgeon use of Lake Borgne is believed to be low, and potential high-value foraging Gulf sturgeon habitat was eliminated from consideration for borrow area placement; therefore, potential adverse impacts to critical habitat would be limited to short-term disturbance in the vicinity of the borrow areas during dredging. Construction activities would be temporary and localized in nature during construction activities. Long-term adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated.

Construction activities associated with the Golden Triangle alternative may result in temporary impacts to the marine life stages for Kemp's Ridley and green sea turtles. Sea turtles could be adversely impacted by in-water work that would include dredge activities that result in temporary, localized turbidity; decreases in dissolved oxygen; and habitat alteration. Noise related to construction and human activity, such as pile driving, may also temporarily disturb sea turtles and may result in avoidance behaviors if sea turtles are present in the alternative's construction area. Other adverse effects of construction may include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. In the long term, impacts associated with the marsh restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit these species.

Potential impacts to bald eagle would be similar to those discussed for the West Grand Terre alternative (Section 4.2.2.4). Potential impacts to bottlenose dolphin would be similar to those discussed for West Indian manatee.

4.3.3 Socioeconomic Resources

4.3.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Golden Triangle alternative is located within Orleans Parish and St. Bernard Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the census tracts in which the alternative is located (Census tracts 17.34, 9801, and 9900), Orleans Parish, St. Bernard Parish, state of Louisiana, and the United States. These data are summarized in Table 4.3-1.

Table 4.3-1. Demographic, Economic, and Social Data for the Golden Triangle Marsh Creation Alternative

Description	Census Tract 17.34	Census Tract 9801	Census Tract 9900	Orleans Parish	St. Bernard Parish	Louisiana	United States
Total population	977	0	0	388,182	45,067	4,663,461	321,004,407
Total minority population*	51	0	0	249,524	12,484	1,670,819	76,872,258
Population under the age of 5	101	0	0	23,322	3,453	310,431	19,853,515
Population 65 and older	287	0	0	50,009	4,629	655,848	47,732,389
Median age	57.1	--	--	35.9	33.6	36.4	37.8
Median household income (dollars)†	$69,115	--	--	$38,721	$45,265	$46,710	$57,652
Population below poverty level (%)	5.7%	--	--	25.4%	19.7%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	66	0	0	38,385	5,302	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation-adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The populations in Orleans Parish and St. Bernard Parish make up 8.3% and 1.0%, respectively, of Louisiana's population. Orleans Parish has a minority population of approximately 64%, which is more than the minority populations of Louisiana (36%) and the United States (approximately 24%). St. Bernard parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the overall United States.

The Golden Triangle MCAs are in Census tract 9801, which also includes a portion of the conveyance corridor that extends into Census tract 9900. The borrow area is in Census tract 9900, which also includes a portion of the access corridor that extends into Census tract 17.34. Census tracts 9801 and 9900 are uninhabited and are therefore not further discussed for the alternative.

The percentage of minority residents in Census tract 17.34 (approximately 5.2%) is less than the parishes, state, and country. The median household income for Census tract 17.34 ($69,115) is 56% more than Orleans Parish, 42% more than St. Bernard Parish, 39% more than Louisiana, and 18% more than the United States. The population living below the poverty level is lower for this Census tract than the parishes, Louisiana, and the United States. The population with a less-than-high-school degree within Census tract 17.34 (6.7%) is less than Orleans Parish (9.9%), St. Bernard Parish (11.8%), Louisiana (10.4%), and the United States (8.5%). Because minority and low-income populations in Census tract 17.34 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Golden Triangle alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative would not require displacements or demographic shifts from implementation of the alternative and the proposed activities would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

None of the Census tracts overlapping with the alternative are identified as an environmental justice population. Furthermore, because the alternative is located primarily on private land, it is unlikely that environmental justice communities outside of the three Census tracts referenced above would use the area for subsistence fishing. Therefore, environmental justice populations would not be disproportionally, adversely affected from construction and implementation of the Golden Triangle alternative.

4.3.3.2 CULTURAL RESOURCES

Affected Environment

A terrestrial cultural resource survey was conducted between December 4 and December 9, 2017, for the three MCAs and one equipment staging area. This survey included an airboat and pedestrian survey, nine bucket auger tests, forty-two piston cores, and one aluminum core to identify subsurface landforms and any evidence of culturally significant materials. The excavation materials were mostly peat deposits, which were not indicative of culturally significant resources. Review and testing of the fill areas did not indicate any evidence of archaeological sites or culturally significant materials (SEARCH 2018a).

A marine remote sensing survey was conducted from December 12 to 21, 2017, and from January 3 to 7, 2018. The remote sensing survey was conducted for the two sediment borrow areas, two pipeline corridors, and one dredge corridor. Analysis of the remote sensing data identified 356 magnetic anomalies, 77 side-scan sonar acoustic contacts, and 115 sub-bottom profiler acoustic reflectors. Of the 548 anomalies, contacts, and reflectors that were analyzed, nine magnetic anomalies in the proposed sediment borrow areas and dredge corridor exhibited characteristics similar to submerged cultural resources (e.g., shipwrecks) (SEARCH 2018a).

Environmental Consequences

The alternative would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. No new cultural resources were identified during the terrestrial survey, and no further testing is recommended within the terrestrial portions of the alternative.

The nine anomalies that exhibited characteristics similar to submerged shipwrecks are located as follows:

- One in the southwest borrow area
- Six in the northeast borrow area
- Two in the dredge access corridor

These anomalies are recommended for avoidance by a minimum distance of 50 m (164 feet) from the edges of the anomaly. If avoidance is not an option, additional archaeological investigation/diver identification is recommended to determine their nature and eligibility for nomination to the NRHP would be implemented (Louisiana Division of Historic Preservation 2018).

Disturbance of the seafloor during construction activities has the potential to encounter and cause long-term adverse impacts to unidentified submerged cultural resources. The possibility of encountering an unidentified and unanticipated submerged cultural resource is always present during dredging and construction activities. Impacts to portions of historic properties that damage characteristics that make them eligible for the NRHP are long term and irretrievable. Restoration measures and management actions, such as avoidance buffers, would be designed to avoid cultural resources to the extent practicable.

Consultation with the Louisiana SHPO and tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative.

4.3.3.3 INFRASTRUCTURE

Affected Environment

The Golden Triangle alternative is uninhabited and is located directly east of New Orleans. The alternative is bounded to the southeast by Lake Borgne and to the southwest by Bayou Bienvenue. The MCAs are located along the Intracoastal Waterway. The closest road is Industrial Parkway, which runs parallel to the Intracoastal Waterway. The MCAs are approximately 2 miles from U.S. Route 90, which runs east–west along the coast. CSX railroads also run along U.S. Route 90 along the coast. Two small private airports are within 10 miles of the alternative: New Orleans Lake Front Airport located east of IHNC and Fishers Field in Meraux. The Bayou Sauvage NWR intersects the alternative.

Several pipeline canals and interconnected bayous run throughout the Golden Triangle alternative. Oil and gas exploration in the area has also resulted in pipelines and wells as shown in Figure 3.2-2. The Entergy natural gas transmission line traverses MCA 3 from west to east. A petroleum flowline also traverses MCA 3 from south to north. Database research indicates that this petroleum pipeline may have been owned by Exxon Pipeline Company/Meraux Terminal but was sold to PBF Energy. All other pipelines listed in the databases are located outside of the fill and borrow area design footprints. The Entergy natural gas line traverses MCA 3 from east to west. Goodrich Petroleum Company LLC is located near the western corner of MCA 3. Southern Natural Gas Company has many pipelines adjacent to MCA 3 and west of fill areas. PXP Louisiana is east of MCA 1 and adjacent to the proposed borrow areas (LCSINC 2019).

Environmental Consequences

The Golden Triangle alternative would result in short-term, minor adverse impacts to infrastructure from localized interruptions to access, public services, and utilities, but it would not cause any long-term impacts to infrastructure. Potential impacts may include unintended interruptions to service and outages, as well as reduced access for the utilities to conduct maintenance activities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure that traverse the alternative. During the alternative's design, the area was surveyed to avoid oil and gas resources. Although most of the existing infrastructure is located outside the direct alternative footprint, there are a few natural gas pipelines that cross MCA 3, including an existing pipeline that crosses the proposed pipeline corridor. To minimize potential impacts during dredge operations, BMPs, including those discussed in Appendix C under Infrastructure, would be implemented to avoid significant impacts to infrastructure. Additionally, the alternative would not affect any highways, other major transportation networks, or other infrastructure.

4.3.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

The Golden Triangle is a narrow band of brackish marsh in Orleans Parish and is between Lake Borgne and the confluence of the MRGO and the GIWW. The IHNC Lake Borgne Surge Barrier stretches across the Golden Triangle Marsh. This area is primarily wetland and open water and is void of business or residential structures; however, some of the property within the alternative is privately owned. Most of the alternative is owned by Chalmette Meadows, LLC and the Bayou Sauvage NWR (managed by the USFWS).

The Golden Triangle area in Orleans Parish is zoned as a "Natural Areas District." It is the largest urban NWR and is located entirely within the city limits of New Orleans (USFWS 2009). In addition, the Golden Triangle Marsh falls within the Bayou Sauvage NWR acquisition boundary, one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018). The alternative was also introduced in the 2012 coastal master plan (CPRA 2012) to mitigate the effects of saltwater intrusion and land degradation.

Similar to Jefferson Parish, both Orleans and St. Bernard Parishes also have established local CZM programs to maintain consistency with Louisiana State and Local Coastal Resources Management Act of 1987. Both parishes are located entirely within the Louisiana Coastal Zone Boundary (Orleans Parish 1985 and St. Bernard Parish 2013). Orleans Parish revised its local CZM in 1985. St. Bernard Parish's local CZM program was finalized in 1982, received federal approval in 1987, and was subsequently updated in 2013. The Golden Triangle falls within EMU 14 Lake Borgne, which is a newly designated unit consisting primary of large expansions of open water in St. Bernard Parish's coastal zone. EMU 14 Lake Borgne is an embayment opening into the Mississippi Sound and the Gulf of Mexico and includes all of the designated Lake Borgne area and a small portion of the Mississippi Sound, and Grand Island (recently relabeled Halfmoon Island on USGS quadrangles) (St. Bernard Parish 2013).

Environmental Consequences

The Golden Triangle alternative would result in no short-term adverse impacts to land and marine management. Implementation of the Golden Triangle alternative would also result in long-term benefits to land and marine management. The alternative would restore marsh in the form of three MCAs, a borrow area, and pipeline corridor connecting the borrow area to the restoration site. A CUP is required for implementation of the Golden Triangle alternative. On August 21, 2019, CPRA received the CUP/Consistency Determination application from the LDNR Office of Coastal Management, which demonstrates compliance with CZMA. This action is consistent with the goals of the 2017 coastal master plan (CPRA 2017a); 2009 *Bayou Sauvage National Wildlife Comprehensive Conservation Plan* (USFWS 2009); and state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Coordination with private landowners is underway.

The alternative would not affect existing land uses within the Bayou Sauvage NWR managed by the USFWS or conflict with the Bayou Sauvage NWR management objectives. Therefore, the alternative would not result in any changes to land and marine management because it would be consistent with the current parish and coastal management, practices, and plans. The alternative would assist both parishes in achieving CZM goals of protecting and improving shorelines and result in a long-term beneficial impact to land and marine management.

4.3.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

Bayous, open marsh areas, and small lakes in St. Bernard Parish and the alternative offer many opportunities for recreation and sightseeing. Louisiana Highway 47 is a designated scenic highway that serves as a corridor to promote sightseeing and enjoyment of the parish's natural and cultural opportunities (St. Bernard Parish 2013). Bayou Bienvenue is an 8-mile designated scenic stream in St. Bernard Parish located from Bayou Villere east of Louisiana Highway 47 to Lake Borgne. Common recreational activities on scenic streams include boating, fishing, birdwatching, canoeing, and kayaking (St. Bernard Parish 2013). The waters surrounding the alternative support swimming, boating, fishing, and oyster propagation. In addition, duck hunting is a common recreational activity on the private lands in the alternative (CRPA and EPA 2019).

The Golden Triangle Marsh falls within the Bayou Sauvage NWR acquisition boundary and offers recreational opportunities such as birdwatching, hiking, boating, wildlife observation and photography, hunting, fishing, and crabbing (USFWS 2019b). According to the 2009 *Bayou Sauvage National Wildlife Comprehensive Conservation Plan* (USFWS 2009), many areas in the NWR have been temporarily closed since the 2005 hurricane season. The refuge would gradually reopen these areas as ongoing recovery efforts are completed. Currently, the Bayou Sauvage NWR serves as one of the last remaining non-hunted sanctuaries in the area for wildlife and presently is not opened to hunting. However, the refuge is considering opening the marshes outside of the Hurricane Protection Levee System to limited youth waterfowl hunting (USFWS 2009).

The primary objectives of the Bayou Sauvage NWR are to provide habitat for the protection of fish and other wildlife. Fishing is one of the main public uses of the refuge. Access to and recreational use of refuge resources are permitted in designated areas and in accordance with state and federal regulations. The refuge sport fisheries and crawfish populations provide sustainable recreational fishing opportunities. The introduction of limited waterfowl hunting is also being evaluated. There are several public access points for fishing activities. There is a handicap accessible observation pier on U.S. Route 90, at the Wayside Park location. The U.S. Route 11 boat launch provides access to anglers whose boat engines are 25 horsepower or less. The Madere Marsh Unit off U.S. Route 90 is a popular site for fishermen to catch bait. Opportunities for crawfishing are also abound at the Madere Marsh Unit (USFWS 2009).

Environmental Consequences

The Golden Triangle alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreational users at the Bayou Sauvage NWR from temporary or partial closures, interruptions to recreational activities, or visual interference or obstruction from construction. These short-term impacts to recreation and tourism would be limited to the construction period for the alternative and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including Bayou Sauvage NWR and other scenic areas.

In the long term, the alternative could have a minor beneficial impact on recreation and recreational fishing because it would benefit and create a habitat for a variety of fish and wildlife species that could use the Bayou Sauvage NWR. The temporary impacts associated with the construction of the alternative would be offset by the potential long-term benefits to tourism and recreation.

4.3.3.6 FISHERIES AND AQUACULTURE

Affected Environment

The Lake Borgne area encompasses 162,505 acres of waters of Lake Borgne. Lake Borgne is an important estuarine system that supports commercial fishing for shrimp, crabs, and oysters. Lake Borgne contains some of Louisiana's prime oyster grounds (USGS 2018). It is also a recreational fishing destination for fishing spotted seatrout, red and black drub, and seasonal fish such as Atlantic tripletail (*Lobotes surinamensis*) (St. Bernard Parish 2013).

Oysters grow in the coastal waters of Louisiana and are an important economic resource. Oystermen harvest oysters from public oyster grounds and from bottom waters leased by private entities for oyster production. There is approximately 1.68 million acres available for public harvest and approximately 385,000 acres currently under lease in the state of Louisiana (Banks et al. 2016). The oyster growing areas in St. Bernard Parish are divided into public oyster growing areas and private oyster growing areas, which are leased by individuals from the state. Recent data indicate that there is approximately 89,124 acres of privately leased oyster grounds and 700,872 acres of public oyster growing areas in St. Bernard Parish (St. Bernard Parish 2013). There are two active oyster leases along the coast in Lake Borgne comprising approximately 0.30 acre.

Commercial fishing is important to the residents and local economy of St. Bernard Parish. Commercial fishing is a year-round activity for many residents of St. Bernard Parish, and sport fishing is important for both residents and visitors. The Pontchartrain estuarine unit, of which St. Bernard Parish is a major component, ranks second in total harvest only to the Barataria Basin area. Louisiana as a whole produces 27% of the fisheries tonnage of the entire United States (St. Bernard Parish 2013). For example, in 2014, oyster landings by volume in Lake Pontchartrain were 3,701,817 pounds and Barataria Basin landings were 4,351,435 pounds. Together these two major estuarine basins made up approximately 65% of state oyster landings by volume for 2014 (Banks et al. 2016). However, despite the problems of saltwater intrusion, subsidence, and land loss, estuarine areas of St. Bernard Parish still serve as important nursery grounds and grow-out areas for many species of fish and shellfish. In the estuaries and offshore waters of St. Bernard, there are many species of commercial and sport fish and shellfish including the alligator gar (*Atractosteus spatula*), Atlantic croaker, black drum, Gulf menhaden, red drum, sand seatrout, sheepshead (*Archosargus probatocephalus*), southern flounder, spotted seatrout, striped mullet, eastern oyster, blue crab, brown shrimp, and white shrimp. Among these, the most commercially important include the Gulf menhaden, white and brown shrimp, blue crab, spotted seatrout, red drum, black drum, spot, sand seatrout, southern flounder, Atlantic croaker, and eastern oyster (St. Bernard Parish 2013).

Within the refuge is a diversity of freshwater and saltwater species. Common freshwater species are bass, catfish, mullet (Mugilidae), crappie (*Poxomis*), minnow (*Phoxinus phoxinus*), and bream (*Abramis brama*). Common saltwater species are flounder, red drum, spotted seatrout, crabs, and shrimp. Fish assemblages in Lake Pontchartrain change seasonally depending on the balance between the amount of freshwater entering the lake from drainages and the amount of saltier Gulf waters that dominate during times of little rainfall. Presently, most fishing in the refuge is by bank fishers. Anglers are seeking brackish-water species deposited in the impoundments during the storm surge. Spotted seatrout fishing and crabbing have increased, whereas largemouth bass (M*icropterus salmoides*) and bluegill (*Epomis macrochirus*) have declined (USFWS 2009).

Environmental Consequences

The Golden Triangle alternative would have short-term, minor adverse impacts to fisheries within the borrow area and MCAs during restoration construction, but it would result in long-term benefits to fisheries and aquaculture. Dredging would relocate benthic and infaunal organism and potentially entrap slow-moving organisms from the borrow areas. In the MCAs, benthic organisms, sessile fish, and invertebrate species may be smothered during fill placement. Impacts to marine vegetation and coastal habitats are described in Section 4.3.2.1. Mobile aquatic animals would likely relocate from the alternative during construction and return after construction activities end. There may be short-term, minor adverse effects on fish eggs and larvae in the immediate area. Early-stage recruitment of defaunated sediments occurs rapidly by opportunistic infauna in coastal systems (Grassle and Grassle 1974; McCall 1977; Simon and Dauer 1977, as cited in EPA 2003). Continued and complex colonization would be more gradual and would depend on environmental conditions after construction activities are complete. Fish and invertebrates are expected to recover as turbidity returns to pre-construction levels. However, beneficial impacts are anticipated over the long term in the marsh habitat because it provides valuable nursery resources for estuarine-dependent fisheries. Access to the marsh habitat would be maintained after construction through dike gapping.

Impacts to the oyster leases in the Golden Triangle area would be similar to the impacts stated above. One of the pipeline corridors passes through a 500-foot-wide area adjacent to the northwest shoreline of Lake Borgne that had been previously cleared of oyster leases. Access routes would avoid oyster leases, and CPRA would conduct oyster assessments on these sites to document pre-construction conditions. The alternative could result in short-term, minor adverse impacts to fisheries and aquaculture during construction; however, such impacts would be minimized through BMPs. Fisheries and aquaculture would experience long-term benefits as a result of marsh habitat creation.

4.3.3.7 MARINE TRANSPORTATION

Affected Environment

The alternative is bounded to the southeast by Lake Borgne, to the southwest by Bayou Bienvenue, to the north by the GIWW, and to the west by the IHNC. The Golden Triangle alternative is located near the confluence of two major navigation and shipping channels, the MRGO and the GIWW. In 1956, Congress authorized the MRGO federal navigation channel to provide a shorter route between the Port of New Orleans and the Gulf of Mexico, which was authorized as a 36-foot deep, 500-foot-wide waterway extending from the IHNC lock to the 38-foot-deep contour in the Gulf of Mexico. Construction started in 1958, and the project was completed in 1968 (USACE 2012). Severe shoaling in the MRGO channel caused by Hurricane Katrina in 2005 led to its deauthorization by Congress in 2006. Through Public Law 109-234, Congress planned for a deauthorization rather than funding channel operation and maintenance, and on June 5, 2008, the MRGO was officially deauthorized from the confluence with the GIWW to the Gulf of Mexico as a federal navigation channel. A rock closure structure was constructed across the MRGO near the Bayou La Loutre Ridge in St. Bernard Parish, Louisiana, in 2009 (USACE 2012). Now, the MRGO channel is no longer a USCG-designated navigable waterway.

The channel was dredged between 1958 and 1968 across existing waterways and through wetlands to provide a shorter route to New Orleans and to enhance shipping interests in the area. After 2005, the USACE ceased dredging the MRGO to maintain deep draft navigation. In 2009, the MRGO was damned south of the Bayou La Loutre south bank natural levee thus preventing the channel’s use by ocean-going ships. A second closure on the MRGO was in place by 2011 with construction of the flood wall across the MRGO south of its crossing of Bayou Bienvenue as part of the IHNC Lake Borgne Surge Barrier Project. This action further segmented the former navigation channel to reduce the risk of storm damage associated with a tidal surge (St. Bernard Parish 2013; USACE 2012).

Environmental Consequences

The Golden Triangle alternative would likely result in short-term, minor adverse impacts to marine transportation, and no long-term adverse impacts to marine transportation would occur. The alternative is located to the south of the GIWW and can only be accessed by boat; therefore, construction would likely result in a temporary increase in marine traffic volumes due to the locations of staging equipment areas in marinas and marshes in and near the alternative. This could result in negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators, but would not result in actual disruptions to larger transportation systems because this impact would be localized and confined to the alternative. A 210-acre access corridor from Chef Menteur Pass into Lake Borgne would be designated as the dredge access corridor to the Golden Triangle borrow area. Equipment would enter the area via the GIWW and into Lake Borgne via the Menteur Pass. Bathymetric surveys show that this access corridor may allow for navigation of equipment to access the borrow area without the need for access dredging. There is also a delineated staged area near the shoreline of Lake Borgne. In addition, all dredge pipe/subline installed within the corridor would be submerged, and navigation lights shall be affixed to buoys every 500 feet or per USCG regulations to notify marine traffic of the submerged pipeline. This would help minimize impacts to marine transportation and navigation.

4.3.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. Existing views may be obstructed or blocked by modifications to the environment (e.g., levee structures and graded areas).

Opportunities for public viewing of the Golden Triangle MCAs, borrow area, pipeline corridor, and access corridor occur along the Bayou Sauvage NWR located on the northern edge of the Golden Triangle restoration area, the GIWW located approximately 0.4 mile from the closest edge of the restoration area, and from the open water of Lake Borgne. Viewers of the Golden Triangle area see a variety of different vegetation and landscape features, including freshwater marshes, brackish marshes, bottomland hardwood forests, lagoons, canals, borrow pits, chenieres (former beach fronts), and natural bayous (USFWS 2009). Vegetation communities that make up the terrestrial and marsh areas are likely to obstruct most long-distance views because of the growth of taller vegetation such as live oak, sugar berry (*Celtis laevigata*), switchgrass (P*anicum virgatum*), and hogcane (A*rundinaria gigantea*). Long-distance views are likely to occur only along the open water of Lake Borgne and offer views of the open water and brackish marsh that are unobstructed by development. The existing viewshed of this area could be characterized as uninhabited natural areas along Lake Borgne.

Environmental Consequences

The Golden Triangle alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction. There would be long-term benefits to aesthetics and visual resources. The Golden Triangle alternative would include construction of three MCAs, a borrow area, and pipeline corridor to connect the borrow area to the restoration site and provide access to the three MCAs. The alternative would result in the creation and restoration of 884 acres of broken marsh and open water to provide intertidal and subtidal habitat. Public viewing of the Golden Triangle alternative area from land is somewhat limited because there are limited areas for viewing of the marsh, as discussed above. From the

Bayou Sauvage NWR, the public would be able to view portions of construction for the creation of the marsh area through the brackish marsh and open water landscape. Opportunities for the public to view the Golden Triangle area from the water may result in more short-term, minor adverse impacts as viewers would be witness construction equipment and activities interrupting the natural landscape. During construction, impacts to visual resources from the alternative would be short term, minor, and adverse because of the presence of construction personnel, equipment, vehicles, and partially completed restoration elements.

After construction, the alternative would result in an improvement to visual resources and aesthetics through the restored coastal habitats to restore degraded brackish marsh. The marshes would serve as a buffer to reduce storm surge and protect and restore wetland, fish, and wildlife habitats within the viewshed. New and restored habitat is anticipated to attract additional birds and wildlife, thereby adding to the enjoyment of the area by recreational users and the general public. Furthermore, the creation of the restoration area and marsh would be perceived as a long-term, beneficial visual effect impact and could result in an improved viewshed and offer visual improvements to recreationalists in the immediate area.

4.3.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

An HTRW study was not conducted because no indication of HTRW had been observed at the alternative (APTIM 2018a).

Subsidence, also known as vertical land movement, was estimated based on subsidence values for regions of coastal Louisiana in the 2017 coastal master plan (CPRA 2017a). CPRA estimated subsidence range of between 0.002 and 0.009 m/year for the New Orleans Landbridge of Orleans Parish (Region 3) (CPRA 2012). In addition, along the coast, the land elevation is decreasing while the mean sea level elevation is increasing, resulting in significant land loss. Subsidence, wind and wave erosion, and altered hydrology are historic causes of land loss that continue to convert land to open water in the area (LCWCRTF and WCRA 1999).

There are many estimates for eustatic sea level rise and subsidence. Tide data have been collected at the Grand Isle, Louisiana, tide gauge since 1947. The published data are a combination of data collected from two tide gauges, Bayou Rigaud and East Point, which are located approximately 0.9 mile apart along the northwest shore of Grand Isle. NOAA calculated the rate of relative sea level rise at Grand Isle using monthly means of tide data collected between 1947 and 2006. According to NOAA, the sea level at Grand Isle is increasing at a rate of 0.0303 feet/year (9.24 mm/year) (NOAA 2018).

The MRGO channel dramatically impacted hydrology and salinity (Shaffer et al. 2009), likely contributed to the severity of the flooding in New Orleans during Hurricane Katrina (van Heerden et al. 2009), and exacerbated wetland loss and damages to estuarine habitats in Louisiana from the other tidal marshes in Breton Sound to the cypress forests and freshwater marshes in the western reaches of the Lake Borgne basin (USACE 2012). It is estimated that the dredging of the MRGO channel and placement of dredged material resulted in the conversion of 19,400 acres of wetlands and 4,750 acres of shallow open water to deep open water or dredge material banks (USACE 1999, 2012).

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may occur during construction of the Golden Triangle alternative. There would be no long-term adverse impacts to public health and safety from the alternative. Construction projects involving the use of boats and barges, and associated equipment, for the placement of materials to create habitat could cause oil, fuel, or other hazardous material spills in surface waters, resulting in short-term, minor adverse impacts. BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, would be incorporated into construction activities on-site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Because of the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to avoid potential water related accidents and conflicts. As discussed above, there is no indication of HTRW near the alternative, which thereby presents no risks to public health and safety. There would be no long-term impacts to public health and safety from the alternative.

No short-term adverse impacts to flood and shoreline protection during construction of the Golden Triangle alternative would occur. This alternative would provide long-term benefits to flood and shoreline protection. The Golden Triangle alternative would create or restore approximately 774 acres of broken marsh and open water, which comprises the restoration of 694 acres of degraded marsh and nourishment of 80 acres of marsh, through the construction of approximately 44,000 linear feet of containment dikes. These marshes would act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands. The alternative would help buffer the surge barrier, which would provide natural storm protection and increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne. As a result, the alternative would help maintain landscape integrity and enhance community resilience and promote natural resource stewardship and environmental education and outreach. Overall this would result in long-term beneficial effects on public health and safety.

4.4 Biloxi Marsh Living Shoreline Alternative

4.4.1 Physical Resources

4.4.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The Biloxi Marsh alternative is in St. Bernard Parish, Louisiana, in the southern portion of the Pontchartrain Basin. The marsh is in the Mississippi River Delta plain and includes the St. Bernard Delta complex, which was created through alluvial valleys onto the continental shelf. The St. Bernard Delta complex buried the Pine Island barrier island and overtime experienced land loss, which led to the formation of the Chandeleur Islands (USGS 2002).

The nearshore elevations in the Biloxi Marsh alternative range from approximately -2.0 to -6.0 feet (NAVD88). The area is underlain by marsh deposits from the Holocene age, consisting of undifferentiated clays and layers of interdelta deposits of sandy soils. Within Bayou La Loutre are natural levee and point bar deposits consisting of silts and sands. Surface soils in the marsh area are part of the Scatlake series, which is described in detail in the affected environment of the West Grand Terre alternative (see Section 4.2.1.1.1). Most of the marine soil borings collected along the proposed breakwaters at the existing mudline near the edge of the marsh revealed top layers of very soft, dark-brown peat, and organic clays underlain by very soft clays with high moisture contents and very soft dark grey peat (Ardaman & Associates, Inc. 2018). Several soil borings collected near the middle of the proposed breakwaters and one soil boring near the eastern terminus of the breakwaters revealed layers of silty sand starting near or below depths of 10 feet below the surface.

Changes to the Biloxi Marsh and surrounding areas from subsidence and sea level rise are the same as those described for the Golden Triangle alternative (Section 4.3.1.1.1).

Environmental Consequences

Adverse impacts to substrates from construction and implementation of the Biloxi Marsh alternative would be short term and minor. The long-term benefits to geology and substrates from implementation of the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

Offshore activities, including the use of barges to excavate, fill and backfill, and construct the alternative, as well as installation of pilings, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of disturbance in the excavated areas would be limited to depths needed to contour the area for intimate contact with the ground surface. Removal of individual stumps within the alternative may require excavation and backfilling; however, this would be limited in scope.

The disturbance of sediments during construction would be small, localized, and temporary and would not result in detectable geologic or substrate changes in the localized area. The placement of materials in the temporary spoils area would result in localized sediment disturbance and compaction. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid disturbance to onshore geology and substrates. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing sediment disturbance and compaction during and after construction.

Once completed, the oyster reef breakwaters would provide long-term benefits to geology and substrates. Placement of reefs would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive shoreline erosion and loss experienced on nearby shorelines and increase the resiliency of coastal wetlands. The long-term benefits to geology and substrates from implementation of the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.4.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

BASINS AND IMPAIRED WATERBODIES

The Biloxi Marsh alternative is in the Pontchartrain Basin, and the hydrology and water quality conditions of the alternative are described for the affected environment of the Golden Triangle alternative (see Section 4.3.1.2.1). The Biloxi Marsh extends from the southeastern shoreline of Lake Borgne into Chandeleur Sound. The marsh crosses segments of the Bayou La Loutre, which was once a distributary of the Mississippi. The marsh is also part of the Biloxi WMA, which provides New Orleans a protective barrier against storm surges and waves.

The western portion of the proposed breakwaters is at the boundary of the Bayou La Loutre MRGO to Eloi Bay (subsegment 042003), an estuarine segment of the Mississippi River, and Eloi Bay (subsegment 042206), an estuary (LDEQ 2004). The eastern portion of the breakwaters would be located in Eloi Bay and in the Morgan Harbor (subsegment 042205), which is also an estuary. Water elevations measured during soil sampling in the alternative ranged from 0.5 feet above sea level to -0.1 feet below sea level (NAVD88). There are no aquifers underlying the Biloxi Marsh alternative, and the closest aquifer is the Mississippi River alluvial aquifer, approximately 30 miles northwest of the western terminus of the oyster leases.

The Biloxi Marsh area has experienced loss and degradation of shoreline and marsh areas from a number of factors, including erosion, which is exacerbated during hurricanes and other storm events that increase wave heights and force, sea level risk, sediment compaction and deprivation, and saltwater intrusion. In addition, the area's hydrology and water quality have been influenced by oil and gas infrastructure and activities and levee construction and maintenance. Despite these ongoing conditions, the water quality in the Biloxi Marsh alternative meets LDEQ's (2017) water quality standards. In 2018, Bayou La Loutre (subsegment 042003), Eloi Bay (subsegment 042206), and Morgan Harbor (subsegment 042205) were listed as fully supporting PCR, SCR, FWP, and OYS and had no water quality impairments (LDEQ 2019a).

WETLANDS AND FLOODPLAINS

The Biloxi Marsh alternative includes saline marshes in the Pontchartrain Basin. The characteristics of the Pontchartrain Basin system of wetlands and the sources of their deterioration are described for the affected environment of the Golden Triangle alternative (see Section 4.3.1.2.1). General flooding conditions for the Biloxi Marsh alternative, including sources of impacts to hydrology and increased flooding severity in the area, are also the same as described for the Golden Triangle.

Tidal levels in the Biloxi Marsh alternative range from 1.1 to -3.0 feet in elevation (NAVD88). During a storm event that would be comparable to a Category 1 hurricane, water levels in the alternative can reach +9.8 feet (NAVD88) (CPRA 2019d). The alternative is located within SFHAs subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone). The marsh areas are in SFHA Zone VE, with BFEs ranging from 18 to 19 feet (FEMA 2017a, 2017b). Eloi Bay is in SFHA Zone V, which, similar to Zone VE, is a coastal flood zone with velocity hazards from waves but does not have a determined BFE.

Environmental Consequences

Construction and implementation of the Biloxi Marsh alternative would result in short-term minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improve overall coastal resiliency.

Anchoring and other offshore activities, including the use of equipment on barges to mobilize and demobilize all equipment, and barges and equipment to excavate and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration.

The disturbance of sediments during construction could lead to the movement of sediments and increased turbidity, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change in wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid surface disturbance that would cause sedimentation and lead to changes in hydrology and water quality. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize impacts on hydrology and water quality by minimizing sediment and pollutant loads into waterbodies and wetlands.

Once completed, the oyster reef breakwaters would provide long-term benefits to hydrology, water quality, and wetlands. Placement of reefs would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive alterations to hydrology and degradations of water quality experienced in the localized area. These long-term benefits to hydrology, water quality, and wetlands from implementation of the alternative would help restore and support natural hydrologic processes and improve overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration, thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.4.1.3 AIR QUALITY

Affected Environment

Air pollution sources in or near the Biloxi Marsh are limited because the area is uninhabited and only accessible by boat. Boat traffic around the alternative is infrequent, resulting in limited contributions to air pollution. There are multiple active and abandoned oil and gas wells and pipelines throughout the area. Activities associated with active oil and gas wells and maintenance of pipelines contribute limited and infrequent air pollution. Similar to the Golden Triangle alternative, the closest major sources of air pollution come from vessel and boat traffic along the GIWW and the MRGO, ports along shipping routes, and urban-industrial areas in and around New Orleans. As described for the West Grand Terre alternative, other sources of air pollution come from the release of soil-sequestered greenhouse gases through wetland degradation.

There are two LDEQ air quality monitoring stations in St. Bernard Parish in the cities of Chalmette and Meraux (LDEQ 2019b), which are described above for the Golden Triangle alternative in Section 4.3.1.3.1, Affected Environment. St. Bernard Parish was designated as a maintenance area for ozone in 1995 and has been classified as a nonattainment area for sulfur dioxide from 2013 through July 2019. The parish has been in attainment for all other NAAQS from 1995 through July 2019.

Environmental Consequences

Construction of the Biloxi Marsh alternative would result in short-term, minor adverse impacts to air quality. In-water construction activities during implementation of the Biloxi Marsh alternative would require the use of machinery and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.4.1.4 NOISE

Affected Environment

The major sources of noise in the marsh area would come from vessel and boat traffic and port activities in the GIWW and the MRGO. Because the Biloxi Marsh is uninhabited and accessible only by boat, other noise sources would be limited to oil and gas development activities and commercial fishing that are prevalent in and around the alternative area. Noise from distant urban areas contribute negligible noise impacts to the alternative.

Environmental Consequences

The Biloxi Marsh alternative would result in short-term, minor adverse noise impacts. Construction of the alternative would generate temporary, intermittent noise associated with vessels and equipment (such as a pile driver) and transport and placement of materials. Noise during construction would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. Following construction of the oyster reef breakwater, anticipated increases in recreational and commercial use of the adjacent oyster beds could lead to noise from users and motorized boats or equipment over the life of the alternative. However, these activities are already present in the nearby oyster leases; therefore, no new adverse noise impact would occur.

4.4.2 Biological Resources

4.4.2.1 HABITATS

Affected Environment

The Biloxi Marsh lies within the Mississippi Alluvial Plain section of the Coastal Plains physiographic province of North America (Fenneman and Johnson 1946). Deltaic environs associated with the Mississippi River and the Gulf of Mexico are complex and include multiple ecosystems ranging from freshwater to saline. The deltaic plain landscape consists of several large interdistributary basins dominated by freshwater and saltwater marshes and numerous shallow lakes and ponds. The Biloxi Marsh lies entirely within the Deltaic Coastal Marshes and Barrier Islands ecoregion, which includes freshwater and saline marshes (Daigle et al. 2006). The Biloxi Marsh consists of more than 100,000 acres of brackish and salt marshes, which have been greatly impacted by shoreline erosion from wind-driven waves. The region has been modified considerably during the last 75 years as a result of artificial changes related to the oil and gas industry. The alternative is crisscrossed by numerous pipelines and human-made canals and has been subject to levee construction and maintenance (SEARCH 2018b).

The alternative is located along the shoreline of Bayou La Loutre, a previous distributary bayou of the Mississippi River into the Breton and Chandeleur Sound. The alternative is characterized by low marsh with an erosional shoreline. Vegetation includes saltmeadow-marshhay cordgrass, black needlerush (*Juncus roemerianus*), and coastal saltgrass. Black mangrove occurs in a few areas, and some live oaks are found along old natural levees. Seagrass meadows (SAV) decrease in the western bays of Chandeleur and Curlew Islands and in the shoals near Freemason, North, and New Harbor Islands, located approximately 17 miles northeast of the alternative. Brackish marsh SAV communities are composed primarily of water celery, widgeon grass, southern naiad (*Najas guadalupensis*), and horned pondweed (*Zannichellia palustris*). These brackish SAV communities grow in sand/mud bottom substrates in shallow, protected waters with low turbidity. Widgeon grass is the main submerged aquatic plant in the alternative (LDFW 2019c). There are no CRMS sites within the alternative; however, one site is approximately 5 miles north near Skiff Lake (CRMS 0124). Dominant vegetation at this monitoring site was smooth cordgrass (CPRA 2019a).

Environmental Consequences

Construction of 9 to 11 miles (and no more than 12.5 miles) of oyster reef would result in minor, short-term adverse impacts to nearshore and benthic habitats. Access to the oyster reef restoration area would require dredging to create a temporary access channel adjacent to the oyster reef placement area, and temporary and permanent placement of spoil on the seaward side of the marsh shoreline. An increase in turbidity of adjacent marine environments from dredging activities associated with trenching, spoil placement, pile driving, and reef material placement may occur in the short term. Dredging may also be required for the placement of the oyster reef materials and/or marine mattresses, and spoil from these activities would be placed on the seaward side of the marsh shoreline between the oyster reef and existing marsh shoreline. The temporary access channel would be restored at the culmination of construction activities; therefore, long-term adverse impacts are not anticipated.

Oyster reefs help protect marsh habitats by reducing shoreline recession. Oyster reefs frequently occur just offshore the marsh edge, and their vertical structure serves to attenuate wave energies and reduce water velocities resulting in reduced erosion as well as increased sediment deposition behind the reef, both of which act to stabilize the shoreline (Campbell 2004; Piazza et al. 2005). As a result, long-term beneficial effects of the oyster reef installation would include shoreline and marsh protection. In addition, minor, long-term beneficial effects from placement of oyster reef materials in marine environments include change of existing habitat from a soft to a hard substrate. By adding vertical habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur. Bioengineered oyster reef can naturally rebuild vertically and respond to sea level rise. Long-term ecological benefits would result as the oyster reef would become a self-sustaining and valuable habitat for many estuarine species and benefit the water quality in the area.

Approximately 24 acres of saline marsh habitat would be lost as a result of the installation of marine mattress materials resulting in long-term, minor adverse impacts. However, benefits related to protection of marsh shoreline are anticipated to be greater than the total area of marsh lost and would be overall beneficial to marsh habitats, in addition to indirect benthic and estuarine ecosystem benefits.

Ground-disturbing activities could result in the spread of invasive species near the areas of the alternative where marine mattresses may be installed, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring, and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.4.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. The Biloxi marshes provide important habitat for a wide range of fish and wildlife species. Coastal wetlands are rich in wildlife resources and provide nesting grounds and important stopovers for waterfowl and migratory birds. Specific to the alternative, continued land loss in and around the alternative and increased salinity have changed the landscape and use of habitat over time.

The Biloxi WMA is located approximately 10 miles northwest of the alternative. Because of Biloxi WMA's tremendous number of bayous, sloughs, and potholes, the area is home to an abundance of fish, shrimp, crabs, waterfowl, and furbearers. There are a few canal spoil banks and ridges scattered throughout the marsh, which provide birds and mammals refuge from rising water levels during storms or high tides (LDFW 2019e). Mammals that may be present are raccoon, squirrels, whitetail deer, mink, river otter, nutria, bats, rodents, and shrews. Alligators are known to be present within the alternative. Brackish wetlands are typically used by many different bird species, including seabirds, wading birds, shorebirds, dabbling and diving ducks, raptors, rails, coots, gallinules, and other emergent brackish marsh residents and migrants. Colonies of nesting birds of various species can be found within the alternative. The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37 (see Section 4.3.2.2).

Environmental Consequences

Short-term, minor adverse impacts to wildlife individuals in the Biloxi Marsh may occur as a result of construction-related human noise and disturbance (such as from pile driving) and available habitat change or loss and ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species and temporary loss of habitat. However, any such impacts would be localized and short term, and most wildlife individuals would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the oyster reef placement activities; therefore, long-term adverse impacts from disturbance are not anticipated. The permanent loss of approximately 24 acres of saline marsh habitat would reduce the overall availability of this habitat across the landscape and result in minor, long-term adverse impacts to this habitat; however, because large expanses of saline marsh habitat are available directly adjacent to the alternative, it is not anticipated that the loss of 24 acres would have large-scale impacts. Overall, the placement of oyster reefs and resultant protection of existing saline marsh habitat are anticipated to be largely ecologically beneficial in the long term. The protection of marsh habitat and creation of additional oyster habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species have the potential to occur within the disturbance area. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential impacts to resident and migratory birds. Therefore, long-term adverse effects to these species would not be anticipated. Construction activities can result in minor, short-term adverse impacts to shorebirds from disturbance and reduced foraging efficiency if the birds are roosting and feeding in the area during a migration stopover. Foraging birds may be temporarily displaced during construction; however, marsh areas are available outside of the disturbance areas and would provide foraging habitat. Long-term benefits of shoreline protection would preserve areas of marsh as a foraging resource. Potential adverse effects from the dredging and oyster reef placement activities would be limited to short-term, minor impacts that include disturbance to birds in nearshore waters from increased human noise and activity. However, such impacts would be localized and temporary, and impacted individuals would likely move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.4.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Tidal marshes provide forage habitat, spawning sites, and a predation refuge, and serve as a nursery for resident and nonresident fishes and macrocrustaceans. These organisms use tidal marshes or adjacent subtidal shallows, either year-round or during a portion of their life history, as nurseries. The existing emergent wetlands and shallow open water within and adjacent to the alternative provide important transitional habitat between estuarine and marine environments used by migratory and resident fish, as well as other aquatic organisms for nursery, foraging, spawning, and other life requirements. Shoreline erosion by wind-wave action is the dominant cause of wetland loss in the alternative.

A number of ecologically and economically important nekton and benthic species are dependent on the availability of suitable tidal marsh habitat. See the Golden Triangle alternative (Section 4.3.2.3) for a discussion of the results of a previous benthic organism surveys in the Biloxi Marsh area. Additionally, the water bottoms around the Biloxi Marsh contain extensive areas of low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). A portion of the alternative is located within oyster seed grounds managed by the LDWF.

The nearest major waterbody to the alternative is Chandeleur Sound, where water depths average 10 to 15 feet (USACE 2012). This waterbody and adjacent wetlands provide nursery and foraging habitats which support varieties of economically important marine fishery species, including striped mullet, Atlantic croaker, Gulf menhaden, spotted and sand seatrout, southern flounder, black drum, and blue crab.

The alternative is in EFH Ecoregion 3 (East Louisiana, Mississippi and Alabama), which extends from Pensacola Bay to the Mississippi Delta. The EFH components within the alternative include emergent wetlands, soft bottoms, and WCA. In the alternative, EFH has been designated for the same species as listed for the Golden Triangle alternative (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.4-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

Environmental Consequences

Minor, short-term adverse impacts to marine and estuarine species would be primarily associated with the dredging of the access channel, pile driving, and placement of oyster reef materials. Construction-related short-term, minor adverse impacts may include increased turbidity, siltation, entrainment of benthic species, disturbance, temperature changes, increased biological oxygen demand due to the introduction of organic matter into water column, and decreased dissolved oxygen. Benthic species within the access channel would suffer localized disturbance and/or mortality from dredging and construction. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often occurring generally within 1 year and achieving community composition similar to undisturbed sites within 2.5 years (Greene 2002; Michel et al. 2013).

Long-term installation of the oyster reef materials would have a beneficial impact. Shell reefs created by oysters provide unique, structurally complex habitat that supports distinct and diverse aquatic communities, functions as nursery habitat for many fish and shellfish species and enhances local productivity (Plunket and La Peyre 2005; Scyphers et al. 2011; Soniat et al. 2004, as cited in CPRA 2014a). Because the reef provides abundant and concentrated prey resources, it is a valuable forage site for transient, predatory fishes such as flounder, drum, and spotted seatrout (Plunket and La Peyre 2005; Scyphers et al. 2011). Oyster reefs would not only prevent the erosion of interior emergent wetlands, but would also protect interior shallow ponds, which are essential nursery habitats for many fishery species. Long-term benefits would include the potential for enhancement of the productivity of local oyster stocks as well as supply recruits to nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole.

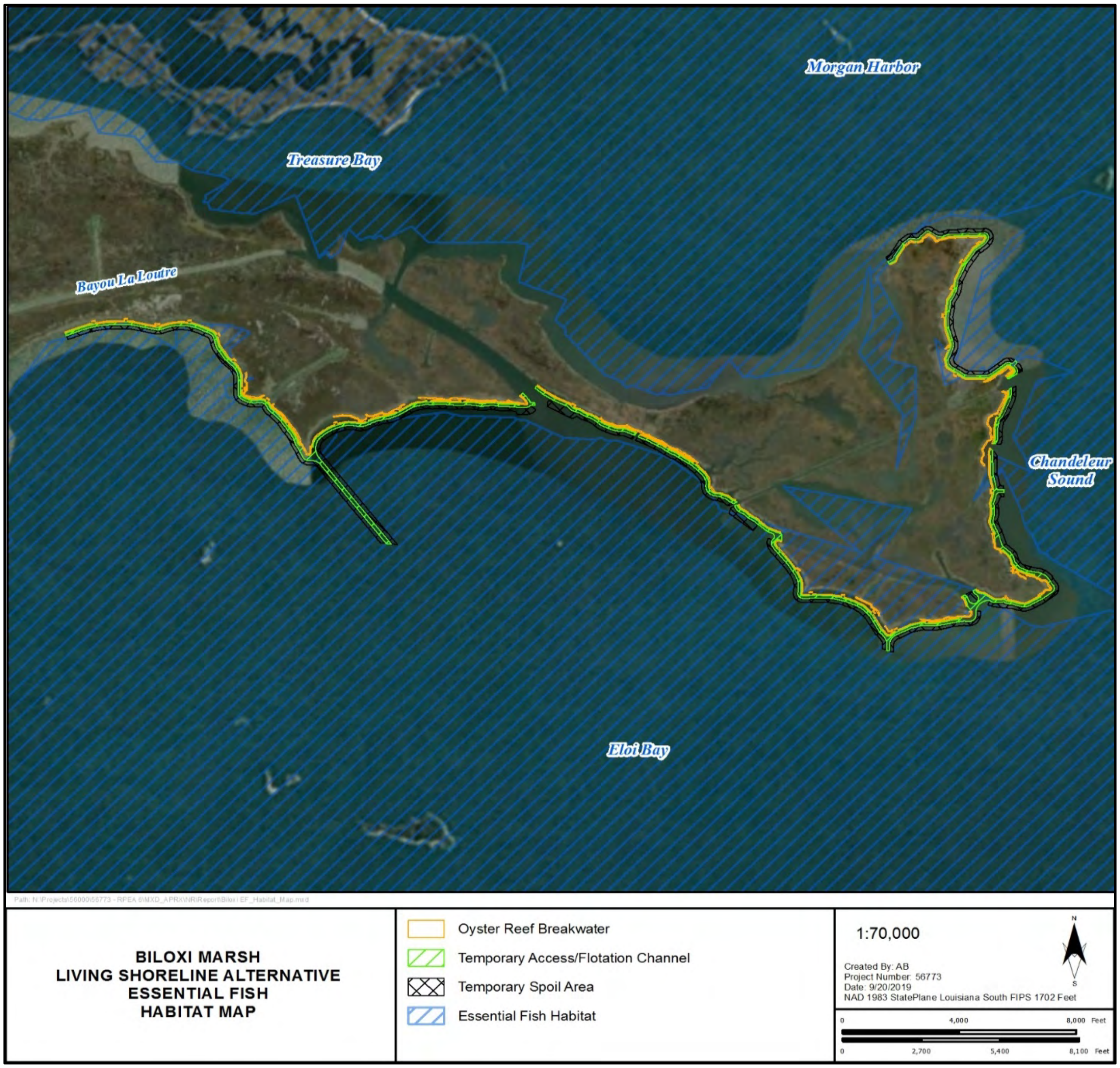

Figure 4.4-1. Essential fish habitat within the Biloxi Marsh alternative.

Short-term, minor adverse impacts to EFH may occur during dredging and oyster reef placement activities. During these activities, species and their prey species may leave the disturbance area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in a temporary disturbance of feeding or spawning and other behaviors by some species individuals. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed oyster reef would result in long-term benefits to estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh protection would also benefit species within the ecosystem by continuing to contribute to the aquatic food web and maintaining a productive habitat.

4.4.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of St. Bernard Parish. The list of species listed as threatened or endangered within this parish is the same as that described for West Grand Terre and described in Table 4.2-2. Because the alternative consists of estuarine and brackish marsh habitats and is located far from the nearest barrier island and/or beach habitat, only five species included in Table 4.2-2 (Gulf sturgeon, West Indian manatee, and three species of sea turtle [loggerhead sea turtle, Kemp's Ridley, and green sea turtles]) have the potential to be present in or near the alternative. There is no critical habitat in the alternative (Figure 4.4-2).

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending upon the life stage of the species and season (NOAA Fisheries 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). Gulf sturgeon are categorized into spawning populations based on the river system they inhabit. Currently, Gulf sturgeon inhabit and spawn in seven river systems, and the Pearl River system is the closest to the alternative. The Pearl River empties into the eastern portion of Lake Borgne near the Rigolets.

The West Indian manatee is known to occur along the southern Louisiana coast (USFWS 2019a). West Indian manatees are common in shallow coastal waters because they feed on submerged vegetation. Although there are no extensive areas of submerged vegetation in the alternative, widgeon grass is present and could provide limited foraging habitat for West Indian manatee. However, no known occurrences of this species has been documented within the alternative; thus, occurrences of this species is rare, and there is a low probability the species would be present (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within or near the alternative.

Three of the five species of sea turtles listed as threatened or endangered within the Orleans and St. Bernard Parishes may occur near the alternative (USFWS 2019a). The nearshore habitats near the alternative do not provide suitable foraging habitat for hawksbill or leatherback sea turtles; therefore, it is unlikely these species would be present (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). Of these three species, only the loggerhead sea turtle may nest within the alternative; the remaining two species (Kemp's Ridley and green sea turtles) would be present but only within the marine environments of the alternative.

Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for these species, these species are not expected to occur in terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The loggerhead, green, and Kemp's Ridley sea turtles may be present within or near the alternative and the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe 2016).

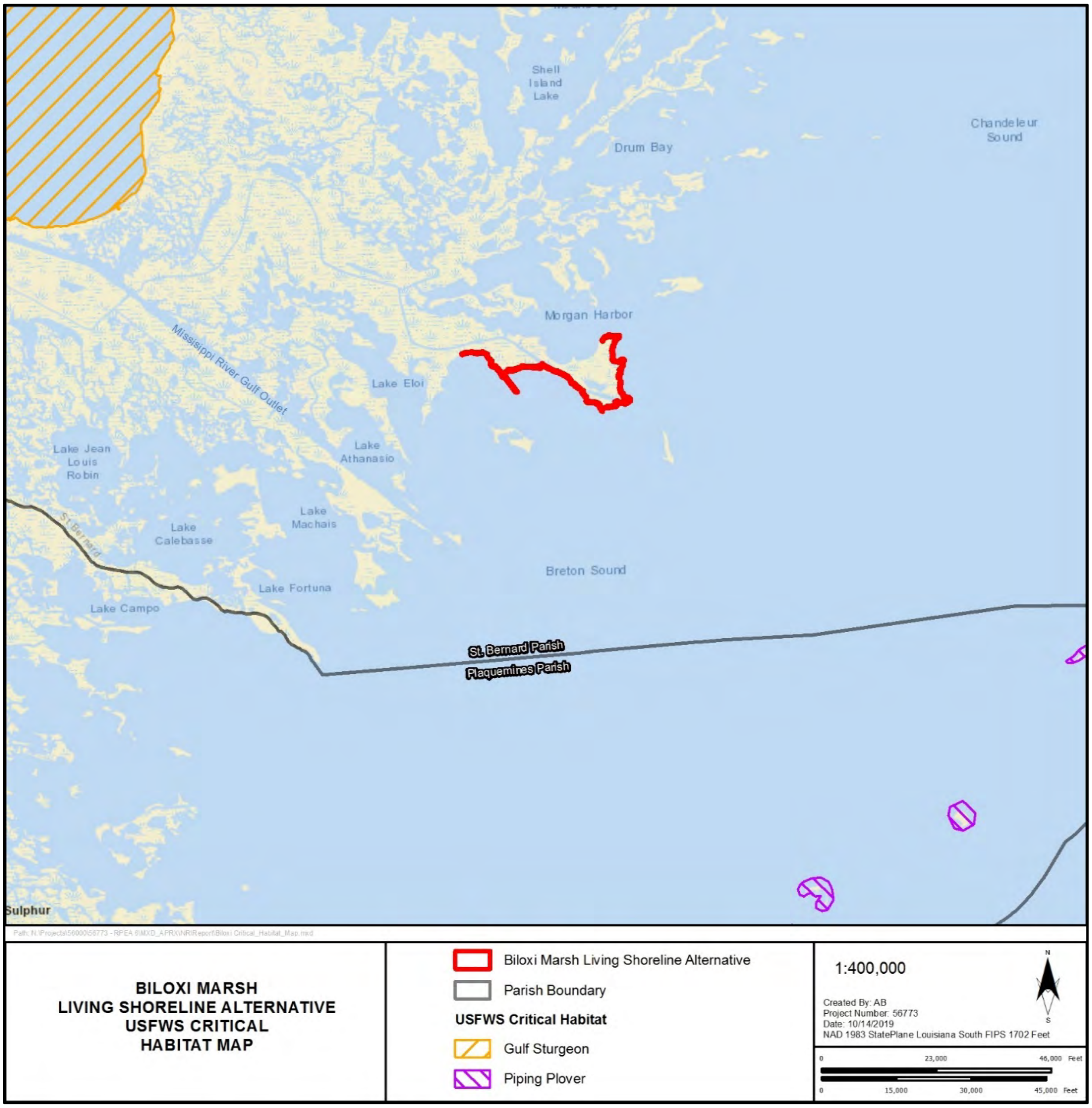

Figure 4.4-2. Critical habitat within Biloxi Marsh Living Shoreline alternative.

Bald eagles are known to breed and winter near the alternative.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents estuarine areas within the region for feeding (Hayes et al. 2019); therefore, this species may be present in the alternative.

Environmental Consequences

Because the alternative contains estuarine habitats, the Biloxi Marsh alternative could result in temporary adverse impacts to adult and sub-adult Gulf sturgeon while overwintering and foraging. Gulf sturgeon could be adversely impacted by dredging, pile-driving, and artificial reef placement activities that result in localized turbidity and habitat alteration caused by dredging activity. Temporary increases in noise related to construction activities (such as pile driving) and human activity may also disturb Gulf sturgeon. These fish are highly mobile; therefore, individuals disturbed by effects from construction activities would likely move to another area. Long-term, adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated because of the localized and temporary nature of the construction activities and the implementation of the Gulf Sturgeon BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS to reduce and avoid potential adverse impacts to this species. Because the long-term effects associated with the Biloxi Marsh alternative are anticipated to be beneficial to ecological conditions of benthic environments in the alternative, the alternative could benefit foraging habitat for this species.

Activities that may result in adverse impacts to manatees present in the alternative are construction-related in-water work that would include dredging and spoil placement for the temporary access channel, pile driving, and placement of artificial reef structures. These activities would result in localized turbidity and construction noise that may result in temporary avoidance behaviors if manatee are present in the construction area. Other adverse impacts include collision with vessels/barges and entanglement with anchor management systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential adverse impacts to this species. The disturbance to manatees would be short term, would be limited to alternative construction, and would result in temporary displacement as individuals would likely move to another area for foraging or resting purposes. Long-term benefits would result because the oyster reef would become a self-sustaining and valuable habitat for many estuarine species and benefit the water quality in the area. The ecosystem benefits could result in improved conditions for SAV, which may provide additional forage for the species.

Construction-related in-water work that may result in temporary adverse impacts to loggerhead, Kemp's Ridley, and green sea turtles would include dredging and spoil placement for the temporary access channel, pile driving, and placement of artificial reef structures. These activities may result in localized increases in turbidity and construction noise that may result in temporary avoidance behaviors if sea turtles are present in the construction area. Other adverse effects of the construction activities include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. Sea turtles would likely avoid or move away from construction activities. The construction of the artificial oyster reef would improve benthic habitat and water quality and could benefit foraging habitat for sea turtles in the area.

Potential impacts to bald eagle would be similar to those discussed for West Grand Terre (see Section 4.2.2.4). Potential impacts to bottlenose dolphin would be similar to those discussed for West Indian manatee.

4.4.3 Socioeconomic Resources

4.4.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Biloxi Marsh alternative is located within St. Bernard Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the census tract in which the alternative would be located (Census tract 301.05), St. Bernard Parish, state of Louisiana, and the United States. These data are summarized in Table 4.4-1.

Table 4.4-1. Demographic, Economic, and Social Data for the Biloxi Marsh Living Shoreline Alternative

Description	Census Tract 301.05	St. Bernard Parish	Louisiana	United States
Total population	305	45,067	4,663,461	321,004,407
Total minority population*	37	12,484	1,670,819	76,872,258
Population under the age of 5	0	3,453	310,431	19,853,515
Population 65 and older	68	4,629	655,848	47,732,389
Median age	50.6	33.6	36.4	37.8
Median household income (dollars)†	--	$45,265	$46,710	$57,652
Population below poverty level (%)	16.1%	19.7%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	54	5,302	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation-adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The population in St. Bernard Parish comprises 1.0% of Louisiana's population. St. Bernard Parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the overall United States.

The Biloxi Marsh alternative is in Census tract 301.05. The percentage of minority residents in Census tract 301.05 (approximately 12.1%) is less than St. Bernard Parish, Louisiana, and the United States. No median household income is reported for Census tract 301.05 because of the small sample size, but the income for most (35%) of the sampled households (152 households) ranges from $35,000 to $74,999, suggesting similar median populations as St. Bernard Parish, Louisiana, and the United States. The population living below the poverty level is lower for this Census tract than St. Bernard Parish and Louisiana and higher than the United States. The population with a less than high school degree within Census tract 301.05 (17.7%) is more than St. Bernard Parish (11.8%), Louisiana (10.4%), and the United States (8.5%). Because minority and low-income populations in Census tract 301.05 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Biloxi Marsh alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative does not require displacements or demographic shifts from implementation of the alternative and the activities for which would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions. The restored and enhanced oyster habitat from implementation of the alternative would provide long-term benefits to the local economy through increased jobs in oyster production and processing. These long-term socioeconomic benefits would benefit a few individuals, groups, or businesses and would not substantively alter social or economic conditions.

The Census tract overlapping with the alternative is not identified as an environmental justice population. Furthermore, if members of an environmental justice population outside of the Census tract referenced above engage in subsistence fishing in or near the Biloxi Marsh, the fishing opportunities would continue in adjacent areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally or adversely affected from construction and implementation of the Biloxi Marsh alternative.

4.4.3.2 CULTURAL RESOURCES

Affected Environment

A marine archaeological investigation for the Biloxi Marsh alternative, including background research, core sampling, and a remote-sensing survey, was conducted from August to October 2017. The Phase I remote-sensing survey included side-scan sonar, sub-bottom profiler, and magnetometer data collection. The side-scan sonar data suggested that intact deposits might be present at three locations. Phase II field testing to determine the presence or absence of submerged cultural deposits included the collection of six core samples and probing the seafloor to identify possible areas of intact shell midden (Fought et al. 2018).

Following analysis of the marine remote-sensing data, it was determined that no historic cultural materials were present within the alternative. Although the side-scan sonar record and magnetometer data yielded multiple potential targets within the survey area, the targets were determined to be modern in origin. The conclusion is fully supported through comparisons to historic maps and aerial imagery, which effectively show that the entire alternative was a terrestrial landscape less than 50 years ago. Instead, the targets identified in the remote-sensing record are associated with oil and gas development activities and commercial fishing prevalent within and around the alternative. No submerged historic cultural sites or materials would be disturbed during alternative construction, and no further work is recommended (Fought et al. 2018). This determination was reached following analysis of the remote-sensing record, field investigation, and analysis of sediment cores. No previously unknown archaeological sites were discovered within the alternative. Additionally, evidence fully substantiates the conclusion that the four previously identified archaeological sites have been destroyed through environmental processes active in the area, including erosion, subsidence, and relative sea level rise. Therefore, the alternative no longer contains any sites eligible for the NRHP, and no further historic evaluation work is recommended for the alternative (Fought et al. 2018).

Environmental Consequences

Because no historic cultural sites or materials were found within the alternative, the Biloxi Marsh alternative would result in no impacts to cultural resources.

4.4.3.3 INFRASTRUCTURE

Affected Environment

The Biloxi Marsh alternative is located along the Biloxi Marsh shoreline from Eloi Point near the mouth of Bayou La Loutre. The alternative is uninhabited, and there is limited infrastructure in this area. The alternative is crisscrossed with pipelines, human-made canals, and levee construction and maintenance. There is a large energy facility close to the alternative (SEARCH 2018b). A Louisiana Intrastate Gas Co. natural gas pipeline crosses the alternative.

Environmental Consequences

No long-term adverse effects from construction of the Biloxi Marsh alternative would result; however, short-term, minor adverse impacts to infrastructure would result. Because of the limited infrastructure and users of that infrastructure, impacts could include localized interruptions to access, public service, and utilities. Utility providers may have reduced access to facilities to conduct maintenance activities, and there could be unintended interruptions to service and outages. Impacts to utilities and public service would likely be localized and within operational capacities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure in the alternative. To minimize potential impacts to existing infrastructure, a 50-foot buffer on both sides of the pipeline would be used, where no dredging would be allowed without prior approval.

4.4.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

The Biloxi Marsh alternative is in St. Bernard Parish along the shoreline of Bayou La Loutre, a previous distributary bayou of the Mississippi River into the Breton and Chandeleur Sound. The Biloxi WMA is owned by the Biloxi Marsh Land Corporation and leased to and managed by the LDWF (St. Bernard Parish 2013). The closest community is Shell Beach, which is approximately 20 miles from the alternative. There are no habitable structures within the alternative, and there are no plans for residential or commercial development at this time. A portion of the alternative is located within oyster seed grounds managed by the LDWF. There are five oyster leases within the alternative.

As discussed above, St. Bernard Parish is located entirely within the Louisiana Coastal Zone Boundary and its CZM program was last updated in 2013. The Biloxi Marsh alternative is located within EMU 9, Bay Boudreau – Bay Eloi (St. Bernard Parish 2013).

Environmental Consequences

Construction of the Biloxi Marsh alternative would result in no short- or long-term adverse impacts to land and marine management, but long-term benefits to land and marine management would occur. The alternative would create bioengineered, marsh-fringing oyster reefs to promote the formation of a living shoreline and provide shoreline protection. This action is consistent with the goals of state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Therefore, the alternative would not result in any changes to land and marine management because the alternative would be consistent with the current parish and coastal management, practices, and plans. A CUP is required for the alternative, and CPRA submitted a permit in December 2018. On August 14, 2019, CPRA received the CUP/Consistency Determination application from the LDNR Office of Coastal Management, which demonstrates compliance with CZMA. The creation of these marshes would also be consistent with the land use with the Biloxi WMA. It is consistent with existing land use in the area and would not adversely affect current land use. The alternative would assist St. Bernard Parish in achieving CZM goals of protecting and improving shorelines.

4.4.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

The alternative is within 10 miles from the Biloxi WMA. The WMA is approximately 25,600 acres and is managed by LWDF. The WMA is the largest publicly accessible wetland in the parish and offers popular locations for hunting, fishing, and bird and wildlife watching; activities that are critically important to the region's economy (St. Bernard Parish 2013). The WMA provides public access for recreational fishing, hunting, and other outdoor related activities, but can only be reached by boat. Within the WMA, hunting and trapping occur for popular game species such as rabbits, rails, gallinules, Wilson's snipe (*Gallinago delicata*), ducks (mallard [*Anas platyrhynchos*], lesser scaup, blue-winged teal [*Anas discors*], American wigeon [*Mareca americana*], gadwall [*Mareca Strepera*], northern shoveler [*Spatula clypeata*], mottled duck [*Anas fulvigula*], and northern pintail [*Anas acuta*]), and snow goose (*Chen caerulescens*). Common fish species include spotted seatrout, red drum, black drum, sheepshead, southern flounder, and Atlantic croaker and recreational and commercial fishman harvest large amounts of crab and shrimp in the area (St. Bernard Parish 2013). Shell reefs created by oysters and oyster reefs are useful to anglers for recreational fishing (CPRA 2014b). The WMA is accessible by boat via commercial launches at Hopedale and Shell Beach (LDWF 2019e). The closest marina is Breton Sound Marina in Hopesdale, which is approximately 15 miles away.

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreational users from temporary or partial closures, interruptions to recreational activities, or visual interference or obstruction from construction. These short-term, minor adverse impacts to recreation and tourism would be limited to the construction period.

When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including the Biloxi WMA. Long-term benefits to tourism and recreational use would be expected from implementation of the alternative by increasing recreational shellfish harvest opportunities as well as enhanced recreational fishing near the constructed reef structures. Restoration could increase the natural productivity of the shallow water area, thereby improving the quality of habitat and increasing oyster recruitment, potentially leading to recreational use. The oyster reefs provide abundant and concentrated prey resources and are valuable foraging sites for transient, predatory fishes such as southern flounder, red and black drum, and spotted seatrout (Plunket and La Peyre 2005; Schyphers et al. 2011, as cited in CPRA 2014a), so these oyster reefs are frequently targeted by anglers. The temporary impacts associated with the construction of the alternative would be offset by the potential long-term benefits to tourism and recreation.

4.4.3.6 FISHERIES AND AQUACULTURE

Affected Environment

As stated above, the Biloxi Marsh alternative is located within St. Bernard Parish, so commercial fisheries in this area are similar to those discussed in Section 4.3.3.6. Species abundant in EMU 9 include Atlantic croaker, red drum, black drum, spot, striped mullet, bay anchovy, Gulf menhaden, sand seatrout, scaled sardine (*Harengula jaguana*), marsh clam (*Polymesoda caroliniana*), eastern oyster, and large quantities of brown shrimp. In addition, EMU 9 contains the largest concentration of privately owned oyster grounds in the parish (St. Bernard Parish 2013). As stated above, oysters are an important commercial fishery species, and the high productivity of Louisiana's oyster grounds has made the state a national leader in oyster landings with annual values typically in excess of $35 million in dockside sales (LDWF 2013). Water bottoms around the Biloxi Marsh contain extensive areas of low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). Oyster reefs also provide unique, structurally complex habitat that supports distinct and diverse aquatic communities and functions as nursery habitat for many fish and shellfish species, which enhances local productivity for both commercial and recreational fisheries (Plunket and La Peyre 2005; Schyphers et al. 2011; Soniat et al. 2004, as cited in CPRA 2014a).

The alternative intersects with five existing oyster leases that make up approximately 330 acres. A biological oyster assessment (T. Baker Smith 2019) was prepared for CPRA for the all oyster leases within 1,500 feet of the alternative in August 2019. Table 4.4-2 includes a breakdown of the acreages for the oyster leases that intersect the alternative.

Table 4.4-2. Oyster Lease Acreage in the Biloxi Marsh Living Shoreline Alternative

Oyster Lease	Alternative Acreage	Lease Acreage	Lease Intersection Percentage
3242207	45.55	92.53	49%
3348008	1.21	61.35	2%
3516112	37.14	46.85	79%
3601815	17.31	91.18	19%
3617515	19.25	39.91	48%
Total	**120.46**	**331.82**	**36%**

Source: T. Baker Smith (2019).

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts to commercial fishing and aquaculture during construction of the bioengineered reefs; however, there would also be long-term benefits to fisheries and aquaculture. Impacts may include displacement and entrapment of nonmobile species from construction equipment, noise, activities or increased turbidity of surface waters from earth-moving equipment and pile driving. These short-term, minor adverse impacts to fisheries and aquaculture from construction could be minimized through the implementation of BMPs.

As stated above, a portion of the alternative is located within oyster seed grounds managed by LDWF. CPRA follows the Oyster Lease Acquisition and Compensation Program per Louisiana Revised Statute (RS) 56:432.1. The statute outlines the process by which CPRA acquires and extinguishes leases within a 150-foot buffer of the alternative. The process requires that a biological survey and appraisal be completed to determine market value. CPRA would then compensate the leaseholder the value of the lease, therefore extinguishing the lease itself and avoiding adverse impacts to the leaseholder. The process has multiple steps and may take up to 1 year. As part of the process, the applicant must notify oyster lease holders about the proposed project and include each affected oyster lease holder a copy of the permit application with forms and plats.

In accordance with the process during construction, oyster lease areas would be buffered by 150 feet to avoid impacts during construction. If unfeasible, oyster leases within the 150-foot buffer would be acquired and extinguished prior to construction. In August 2019, a biological assessment was performed, and the value of the leases is to be determined. A portion of the oyster leases may have to be purchased before construction of the alternative can begin.

Long-term beneficial impacts to fisheries and aquaculture would be expected from implementation of the restoration by ultimately increasing recreational and commercial shellfish harvest opportunities. Restoration could increase the natural productivity of the shallow water area, thereby improving the quality of habitat and increasing oyster recruitment, potentially leading to increased revenue from commercial and recreational activities. Continued monitoring of the alternative would be critical to determine the conditions (e.g., sediments, salinities) under which bioengineered oyster are sustainable and effective in reducing erosion and providing other ecosystem services. Oyster reefs are designated as EFH for red drum and white and brown shrimp. Once established, the alternative could enhance the productivity of local oyster stocks. An increase is the areal coverage of oyster reefs could lead to an increase in nursery and foraging habitat for those species resulting in a long-term beneficial impact to fisheries and aquaculture.

4.4.3.7 MARINE TRANSPORTATION

Affected Environment

There is no official marine transportation infrastructure in the alternative. Transportation in this area consists of commercial and recreational vessels that use the deeper tidal channels, bays, and lakes. There is a segment of the MRGO that remains open along the southern boundary of EMU 9. Bayou La Loutre is the only large waterway providing access between the Chandeleur Sound and Gulf of Mexico and interior camps, fishing villages and docking facilities (St. Bernard Parish 2013).

Environmental Consequences

Construction and implementation of the West Grand Terre alternative would result in short-term, minor adverse impacts to marine transportation, but no long-term adverse impacts to marine transportation would occur. The alternative is unlikely to impact marine transportation because there is no official marine transportation in the alternative. During construction, there could be short-term, minor adverse impacts from small increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. There is no upland access to the restoration area, so access would be obtained from a navigable waterway such as Brenton Sound via the Mississippi River. Shipping routes would be identified prior to the selection of reef restoration sites to prevent any impacts to marine transportation.

Construction activities would take place from the water. Activities related to construction would require coordination with the users of the waterway. Barges would be staged adjacent to the restoration sites and not within approved waterways. It is expected that activities would not interrupt marine traffic or disrupt marine transportation.

Most commercial traffic would take place on a routine schedule, and construction activities would be timed to reduce any interference with commercial operators. In addition, USCG-approved permanent NAVAIDS would be installed approximately every 1,000 feet, or per USCG specifications. These NAVAIDS would warn vessel operators of the breakwater and would be permanently installed in key locations using pile driving to avoid potential impacts to vessels. Temporary warning signs would also be located seaward of the temporary spoil placement areas to warn mariners of limited depth or blocked passage. These signs are anticipated to be pile-mounted or buoy-mounted dayboards placed at approximately 1,000-foot increments along the temporary spoil placement areas. Overall, there would be no long-term impacts to navigation as a result of the alternative, and the bioengineered oyster reef would not impair navigation in or around the alternative.

4.4.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Opportunities for public viewing of the Biloxi Marsh alternative are based from the open water of Eloi Bay, Bayou La Loutre, canals, and natural bayous. Views from the open waters would include vegetation within the Biloxi Marsh landscape including predominately emergent wetland vegetation, such as marsh grasses. The vegetation and topography in the area allow for long-distance views in and near the restoration area.

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction. There would be long-term benefits to aesthetics and visual resources. Modifications to the existing viewshed may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective. Public viewings of the Biloxi Marsh alternative would likely be from the open waters because there are no land developments within the immediate viewshed. If viewing from boats and open water, viewers would be able to see construction of the bioengineered reefs among the existing viewshed of open water, marsh grasses, and vegetation. The construction would temporarily alter the natural viewshed. Construction activities would be expected to have a minor, short-term adverse impact on aesthetics and visual resources in Eloi Bay, Bayou La Loutre, canals, and natural bayous by the presence of barges, excavators, marsh buggies, tugboats, and workers on the water at construction sites. After construction, the alternative would result in an improvement to visual resources and aesthetics through the oyster reefs and reduced shoreline erosion that fragments the marshes in the alternative. Restoration of the oyster reefs would be expected to have a long-term benefit to the aesthetics and visual resources by improving wildlife variety and abundance. Furthermore, the creation of the restoration area and marsh would be perceived as a beneficial visual impact and could result in an improved viewshed and improved viewsheds for recreationalists in the surrounding area. Long-term benefits related to the aesthetics would be expected as the bioengineered oyster reefs continue to develop over time.

4.4.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

The Biloxi Marsh consists of approximately 189 square miles (49,000 hectares) of brackish and salt marshes that have been greatly impacted by shoreline erosion from wind-driven waves, with shoreline retreat rates ranging from 1 to 4 m per year (CPRA unpublished data as cited in CPRA 2014a). Marshes serve as an important storm buffer for the city of New Orleans (CPRA 2014a). Submergence of the wetlands (through land subsidence and sea level rise) and marsh edge erosion by waves are the predominant natural processes affecting the alternative. Between 1932 and 2008, EMU 9 lost approximately 21,582 acres of land.

Recent trends show that interior embayments are increasing in size and depth. St. Bernard Parish predicts that in the absence of effective shoreline protection measures, these embayments would merge into the Chandeleur Sound in the future. Larger volumes of higher salinity waters are moving further inland as the land erodes (St. Bernard Parish 2013). The offshore location of the Breton and Chandeleur barrier islands provides little wave energy protection to the estuary behind them, resulting in shoreline erosion by wind-wave action, which is the dominant cause of wetland loss in the alternative (CPRA 2015).

A shoreline change analysis was conducted by evaluating shoreline positions derived from aerial photography from 1952 to 2010 (Coast & Harbor Engineering 2014). The results of the analysis show that the alternative shoreline is erosional, with long-term retreat rates ranging from a low of -5 feet per year to as much as -20 feet per year. After Hurricane Katrina in 2005 there was a dramatic spike in shoreline retreat, with rates varying from -16 feet per year to -47 feet per year from 2004 to 2005 post-Katrina. Relative sea level rise contributes approximately -1 foot per year to the retreat rates along the shoreline. This indicates that most of the shoreline retreat is a result of wave energy (Coast & Harbor Engineering 2014).

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may result from construction of the Biloxi Marsh alternative. There would be no long-term impacts to public health and safety from the alternative. Short-term, minor adverse impacts to public health and safety may occur during construction. Construction projects involving the use of boats, barges, and associated equipment for the placement of materials to create marshes could cause oil, fuel, or other hazardous material spills in surface waters, resulting in short-term, minor adverse impacts. BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, would be incorporated into construction activities on-site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Because of the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water-related accidents and conflicts are minimized.

There would be no short-term or long-term adverse impacts to flood and shoreline protection during construction of the this alternative. This alternative would also result in long-term benefits to flood and shoreline protection. The Biloxi Marsh alternative would create 9 to 11 miles of oyster barrier reef along the eastern shore of Biloxi Marsh to reduce shoreline erosion. The living shoreline products would function to dissipate wave energy before it reaches the shoreline, thereby protecting vulnerable shoreline and valuable marsh behind. Oyster reefs help protect marsh habitats by reducing shoreline recession. Oyster reefs frequently occur just offshore of the marsh edge, and their vertical structure serves to attenuate wave energies and reduce water velocities resulting in reduced erosion as well as increased sediment deposition behind the reef, both of which act to stabilize the shoreline (Campbell 2004; Piazza et al. 2005, as cited in CPRA 2014a). Of those that have been adequately monitored, these types of projects have shown that they can significantly reduce shoreline recession and support good oyster recruitment and survival, such that the reefs created may be self-sustaining (Melancon et al. 2013; Piazza et al. 2005, as cited in CPRA 2014a). The alternative would yield similar positive long-term benefits to flood and shoreline protection.

The Biloxi Marsh reefs, therefore, could supply recruits to expedite recovery of flood-damaged oyster grounds, as well as other nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole. These shoreline protection features would serve as an important first line of defense for coastal marshes in the alternative, functioning to help sustain the lower Biloxi Marsh, an important landbridge separating the Gulf of Mexico from Lake Borgne, by helping to prevent and/or reduce the rate of erosion of the marshes and shorelines along the shores of Eloi Bay.

In addition to improved coastal resiliency, there would be benefits to public health and safety from the increased filtration of pollutants by oysters in the form of cleaner water. Overall, the alternative would result in long-term major beneficial impacts as a result of construction of the bioengineered oyster reef.

4.5 Fifi Island Forested Ridge with Breakwater Alternative

4.5.1 Physical Resources

4.5.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

Fifi Island is in Jefferson Parish, Louisiana, and is less than 0.25 mile north of Grand Isle on the Mississippi River Delta plain in the Barataria Basin. The island is accessible only by boat and includes undeveloped coastal land dominated by marshland and intertidal wetlands. The coastal marsh geology of Fifi Island is characterized by Holocene back-barrier marsh and mangroves, with Scatlake series surface soils and Scatlake muck substrates. The characteristics of these soils and substrates and the geology of the Barataria Basin are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.1).

Fifi Island provides wave and tidal erosion protections to inhabited Grand Isle, and both Fifi Island and Grand Isle provide storm surge protections to coastal Louisiana. Similar to other islands along the Louisiana coast, Fifi Island has experienced persistent degradation and erosion. Several restoration and stabilization efforts have occurred on and around the island including deposits of dredged sediments as part of USACE's Fifi Island dredged material placement plan, construction a rock breakwater structure on the northwest end of Fifi Island, and construction of a floating wave abatement facility on the northeast end of the breakwater structure that was destroyed in 2005 by Hurricane Katrina (FEMA 2012). Despite these efforts, the island continues to experience shoreline and land changes due to subsidence and sea level rise, resulting in less protections to the neighboring Grand Isle.

Environmental Consequences

The Fifi Island alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

Offshore activities, including anchoring of vessels and the use of equipment, barges, and vessels to excavate, fill, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of disturbance in the excavated areas would be limited to depths needed to contour the area for intimate contact with the ground surface.

The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to changes to geologic features. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. Vegetation would be installed in the ridge creation areas to prevent exposure of soils and sediments and reduce erosion.

The placement of materials in the access channel, ridge, and breakwater areas would result in localized sediment disturbance and compaction and may affect sediment dynamics over the life of the alternative. Where the constructed breakwater segments overlap with shoreline or land, existing substrates and geology would be permanently covered to protect the area from shoreline erosion.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid disturbance to onshore geology and substrates. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing sediment disturbance, erosion, and compaction during and after construction. Adverse impacts to substrates from construction and implementation of the Fifi Island alternative would be short term and minor.

Once completed, the construction of the breakwater and ridge area would provide long-term benefits to geology and substrates. The depositions of sediments in the ridge creation area would raise substrate elevations, leading to increases in the resilience of the coastal wetlands to sea level rise and reducing coastal erosion. Placement of breakwaters would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive shoreline erosion and loss experienced on Fifi Island and increase the resiliency of coastal wetlands. The long-term benefits to geology and substrates from the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.5.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

BASINS AND IMPAIRED WATERBODIES

The Fifi Island alternative is in the Barataria Basin in Barataria Bay (subsegment 021101). The hydrology and water quality conditions of the Barataria Basin and Barataria Bay are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.2). The Bay Des Ilettes is north of the island, and the Bayou Rigaud is south of the island. There are no aquifers underlying Fifi Island; the closest aquifer is the Mississippi River alluvial aquifer, approximately 40 miles north of the island (LDEQ 1988). Water levels in the ridge creation area vary with storm surges and tides and are on average approximately -5 feet NAVD88.

WETLANDS AND FLOODPLAINS

The wetlands of Fifi Island are part of the system of intertidal vegetated and coastal wetlands in Barataria Bay. The island is in a SFHA Zone VE with a BFE of 11 feet and is not in an area identified as a Coastal Barrier Resources System or Otherwise Protected Area (FEMA 2018). Tidal flows between Barataria Bay and the Gulf occur in the Barataria Pass, which separates Fifi Island and Grand Isle to the west from West Grand Terre Island to the east. Marshes on and around Fifi Island are often ponded or flooded. Wetland, tidal, and marsh systems are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.2).

Environmental Consequences

Construction and implementation of the Fifi Island alternative would result in short-term and minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

Anchoring and other offshore activities, including the use of barges to mobilize and demobilize all equipment and the use of barges and equipment to excavate, backfill, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration. The disturbance of sediments during construction could lead to the movement of sediments and increased turbidity, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change in wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid surface disturbance that would cause sedimentation and lead to changes in hydrology and water quality. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. The alternative's design would implement BMPs, including those described in Appendix C for Hydrology and Water Quality, to minimize impacts on hydrology and water quality by minimizing sediment and pollutant loads into waterbodies. Therefore, construction of the Fifi Island alternative would result in short-term, minor adverse impacts on hydrology, water quality, and wetlands.

Once completed, the breakwater and ridge area would provide long-term benefits to hydrology, water quality, and wetlands. Creation of the ridge area would raise substrate elevations and re-establish natural hydrology needed to support the restoration of coastal wetland functions. Placement of breakwaters would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive alterations to hydrology and degradations of water quality in the localized area. These long-term benefits to hydrology and water quality from implementation of the alternative would restore and support natural hydrologic processes and improve overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources, including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.5.1.3 AIR QUALITY

Affected Environment

Fifi Island is uninhabited and only accessible by boat. As a result, air pollution sources on the island are limited to infrequent boat traffic. Activities on Grand Isle, which is less than 0.25 mile south of Fifi Island, including oil and gas pipeline and processing facilities and residential activities on the eastern side of Grand Isle, would contribute to air pollution; however, these would be limited because of the sparse nature of developed areas on Grand Isle compared to the more heavily populated urban-industrial corridor from New Orleans to Baton Rouge, which would be the major source of air pollution in the area, as described for the West Grand Terre alternative (see Section 4.2.1.3). The degradation of wetlands would also be a major source of air pollution in the area. Air quality conditions on Fifi Island are the same as those described for the affected environment of the Jefferson Parish portion of West Grand Terre alternative (see Section 4.2.1.3).

Environmental Consequences

Construction of the alternative would result in short-term, minor adverse impacts ton air quality. The alternative’s in-water construction activities would require the use of machinery and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.5.1.4 NOISE

Affected Environment

Because Fifi Island is uninhabited and accessible only by boat, noise in and around the ridge creation area is limited. Activities and associated vessel traffic at Grand Isle Tank Battery/Shorebase, transient vessel traffic, and nearby inhabited areas on Grand Isle are the only noise-generating sources in the immediate area. Noise from distant urban areas and other oil and gas production facilities contribute negligible noise impacts to the alternative.

Environmental Consequences

The Fifi Island alternative would result in short-term, minor adverse noise impacts. The Fifi Island alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials during construction. Noise during construction would be localized. The closest residences and potentially sensitive noise receptors to the alternative are located on the adjacent shores of Grand Isle. However, the distance between the alternative and these receptors would help noise dissipate during construction, and short-term, minor adverse noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. The alternative would not result in long-term noise impacts, and there would be no noise benefits from implementation of the alternative.

BMPs, including those described in Appendix C under Noise, would be implemented into the alternative's design as appropriate to minimize noise impacts.

4.5.2 Biological Resources

4.5.2.1 HABITATS

Affected Environment

The alternative is in the Barataria Basin at the southern extent of the Mississippi alluvial plain, located within the larger deltaic coastal marshes and barrier islands ecoregion, which is dominated by brackish and saline marshes (Daigle et al. 2006). Fifi Island is located behind Grand Isle, which is part of a barrier island chain the separates Barataria Bay from the Gulf of Mexico. Fifi Island makes up the north bank of Bayou Riguad, a navigational channel, which separates Grand Isle and Fifi Island. Portions of Fifi Island have been subject to restoration and construction activities since the early 1980s, and most recently a rock-armored containment levee was constructed at the northeast end of the island in 2004, and portions of a rock dyke/breakwater were constructed in 2014. Saltwater marsh, constructed armaments and breakwaters, and beaches are the prevalent ecologic features in of the island. Barataria Pass, a natural tidal channel, is located to the west of the island. Freshwater inputs to the Barataria Basin are primarily rainfall because the construction of levees along the Mississippi River has prevented freshwater and sediment inputs to the basin.

Habitats on Fifi Island include salt marsh, which is a regularly tidally flooded, flat, polyhaline area dominated by salt-tolerant grasses and few other species. Salt marsh in the area is largely dominated by smooth cordgrass broken up by areas of open water and intertidal zone. There are no CRMS sites on Fifi Island; however, a site is located approximately 6 miles northwest near Raccoon Bayou (CRMS 0178). Dominant vegetation on Fifi Island is smooth cordgrass (CPRA 2019a). Salt marsh is considered an important nursery area for shrimp, crabs, and a variety of fish species and enhances the production of marine organisms in adjacent waters (Holcomb et al. 2015). Pockets of black mangrove may also form stands in calm waters. Salt marshes and mangrove habitats are integral parts of the Louisiana coastal island system. Species distribution is generally determined by a combination of an elevation gradient and exposure to saltwater spray. Marine submergent aquatic vegetation may occur in the bays and lagoons behind barrier islands. The areas adjacent to the island and existing marshes may provide suitable conditions for SAV; however, no site-specific surveys have been conducted.

Environmental Consequences

Construction of a temporary access channel, breakwater, and ridge would result in minor, short-term adverse impacts to nearshore and benthic habitats. Access to the proposed breakwater and ridge area would require dredging to create a temporary access channel and permanent placement of sediment within the footprint of the ridge. An increase in turbidity of adjacent marine environments from dredging activities associated with trenching, sediment placement, and rock and breakwater placement may occur in the short term. In the access channel, minor, short-term adverse impacts to benthic resources would occur as the sediment is removed. Long term, benthic resources in disturbed areas would reestablish from adjacent undisturbed areas. Following construction, the access channel would return to ambient conditions and be re-colonized by benthic populations within 1.0 to 2.5 years (Greene 2002; Michel et al. 2013). Therefore, these adverse impacts would be short term.

The construction of the proposed breakwater and forested ridge would result in minor, long-term adverse impacts via permanently altering the open water areas where these elements are proposed because of the reduction in marine habitat from rock placement. Although these adverse impacts would affect habitats in localized areas, the footprint of the breakwater and forested ridge would be limited in area, and the overall effects would be minor and long term. Disturbances to open water areas during construction would result in short-term, minor adverse impacts to terrestrial, nearshore, and marine habitats. Minor, long-term beneficial effects from placement of rock in marine environments would include a change of existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur. Some mobile species may be able to move out of the disturbed area, and wildlife would likely use plentiful suitable habitats nearby during construction activities. Therefore, the alternative would not have adverse, long-term effects on terrestrial, estuarine, coastal nearshore, or marine habitats. Overall, the creation of approximately 22 acres of coastal live oak-hackberry forested ridge would benefit available terrestrial habitats.

Ground-disturbing activities could result in the spread of invasive species near the breakwater and ridge areas of the alternative, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species.

4.5.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. Wildlife species may inhabit the terrestrial and intertidal habitats on Fifi Island. Semiaquatic mammals include muskrat, mink, otter, and nutria. Terrestrial mammals include white-tailed deer, rabbit, raccoon, squirrel, and opossum. Species typically found in the Gulf salt marsh environments and that may be present on Fifi Island are the Gulf salt marsh snake, the Gulf Coast toad, and the diamondback terrapin (Abernethy 1987).

Because of its location along the Mississippi flyway, many families of birds may be present in the alternative and include waterfowl, wading birds, diving birds, colonial nesting birds, songbirds, shorebirds, migratory birds, seabirds, and raptorial birds. Most birds, however, are present in the area from approximately October until March or April. The habitats within the alternative support various migratory bird and waterfowl species. The shallow waters and beaches in the alternative serve as foraging habitat for a number of seabirds, wading birds, and other species. Beach and marsh environments may provide habitat for American golden-plover (*Pluvialis dominica*), American oystercatcher (*Haematopus palliatus*), long-billed curlew (*Numenius americanus*), upland sandpiper (*Bartramia longicauda*), and buff-breasted sandpiper (*Tryngites subruficollis*) during spring migration. Beaches provide habitat for gulls, terns, and shorebirds. Wooded areas on nearly Grand Isle support various songbird species such as vireos (*Vireo* spp.), thrushes (Turdidae), waterthrushes (*Parkesia* spp.) and other warblers (Parulidae), summer (*Piranga rubra*) and scarlet tanagers (*P. olivacea*), rose-breasted grosbeak (*Pheucticus ludovicianus*), and Baltimore oriole (*Icterus galbula*) (Gibbons et al. 2013). Many colonial waterbirds use mangroves as nesting areas. Predatory birds such as kestrel (*Falco sparverius*), owls (*Strix* spp.), and falcons (Falconiformes) also are found in the region. Although there is no official species list for the birds of Fifi Island, a species list from neighboring Grand Isle (located approximately 0.3 mile southeast of Fifi Island) reports 305 species (Lepage 2019).

Environmental Consequences

Short-term, minor adverse impacts to wildlife individuals may occur as a result of construction-related human noise and disturbance, available habitat change or loss, and ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Wildlife in and around the alternative may be sensitive to changes in noise sources or levels due to construction. Noise from construction equipment may disturb migratory and shorebirds resulting in short-term, minor to moderate impacts. These noises could be slightly more disturbing to any resting or roosting birds that may use the site compared to baseline conditions. As previously discussed, the alternative would include BMPs described in Section 6, Appendix A of the Final PDARP/PEIS to reduce potential effects from construction-related activities, and coordination with LDWF as part of E&D to avoid and minimize effects to species would be conducted prior to construction. Potential short-term adverse impacts to wildlife would be minimal.

Several migratory bird species have the potential to occur within the alternative. However, much of the proposed work would occur in open water areas and would not involve vegetation clearing. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential adverse impacts to resident and migratory birds. Therefore, adverse effects to these species would not be anticipated. Impacts to terrestrial wildlife would be similar to those described for migratory birds. Overall, long-term benefits from the creation of approximately 22 acres of coastal live oak-hackberry forested ridge habitat would include an increase in available habitat for terrestrial wildlife species, including resident and migratory birds.

4.5.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the island. Similar marine and estuarine species are anticipated to be present in and around Fifi Island as described for the West Grand Terre alternative in Section 4.2.2.3. The wetlands, flats, and subtidal habitat around Fifi Island provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Invertebrates such as crabs and clams also inhabit the intertidal zone. The marsh community provides highly productive nursery areas for shrimp, crabs, and fish. The cover and food mangroves provide excellent nursery areas for fish and shellfish. Freshwater mollusks and crustaceans found near Grand Isle include freshwater clam (Unionida) and brackishwater clam (*Rangia cuneata*), freshwater mussel (Unionidae), river shrimp (*Macrobrachium ohione*), and swamp crawfish (*Procambarus clarkii*). Oyster leases are present along the northern side of the island (LDWF 2019b).

The alternative is in EFH Ecoregion 4 (East Texas and West Louisiana), which extends from the Mississippi Delta to Freeport, Texas. The EFH components within the analysis area include emergent wetlands, soft bottoms, and WCA. In the alternative, EFH has been designated for the same species as described for the West Grand Terre alternative (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.5-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

Environmental Consequences

Minor, short-term adverse impacts to marine and estuarine species would be primarily associated with the dredging of the access channel and placement of fill and rock. In-water work associated with the construction of the breakwater and forested ridge would consist of dredging an access channel, filling the forested ridge area, and placing rocks for the breakwater in open water areas. Alternative elements would permanently affect the shoreline area and benthic habitats where the breakwater and ridge are proposed.

Short-term minor adverse impacts may include increased turbidity, siltation, entrainment of benthic species, temperature changes, increased biological oxygen demand due to the introduction of organic matter into water column, and decreased dissolved oxygen; however, impacts as a result of dredging and fill and rock placement would be short term. Minor, short-term adverse impacts to any slow-moving or sessile benthic organisms found within the access channel and breakwater and ridge footprints could occur through removal of sediment or burial from placement of sediment (as discussed in Section 4.2.2.3), respectively. More mobile benthic species would likely be displaced, whereas other impacts to the benthic fauna would be localized and confined to construction areas. Species within the access channel and ridge and breakwater footprints would experience localized disturbance and/or mortality from dredging and construction. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often generally within 1.0 year and achieving community composition similar to undisturbed sites within 2.5 years (Greene 2002; Michel et al. 2013). In the long term, the footprint of hard structures such as breakwaters changes existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, beneficial changes to the benthic community may occur, such as increased populations of oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

Although these adverse impacts may affect aquatic fauna and EFH in localized areas, the footprints of the breakwater and ridge are limited, and short-term, minor disturbances are expected to be limited in scope and duration. Temporarily disturbed aquatic fauna would likely find refuge in plentiful suitable habitats nearby. Therefore, the construction of the breakwater and ridge would result in short-term minor effects on aquatic fauna. Short-term, adverse impacts to EFH during dredging of the access channel and construction activities may occur. During these activities, species and their prey species may leave the disturbance area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in a temporary disturbance of feeding or spawning and other behaviors by some species individuals. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. Long-term adverse effects to EFH would not occur. Beneficial changes to the benthic community may occur in the long term from the construction of the breakwater and forested ridge, as adding habitat complexity may attract new species of attached organisms, such as increased populations of oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

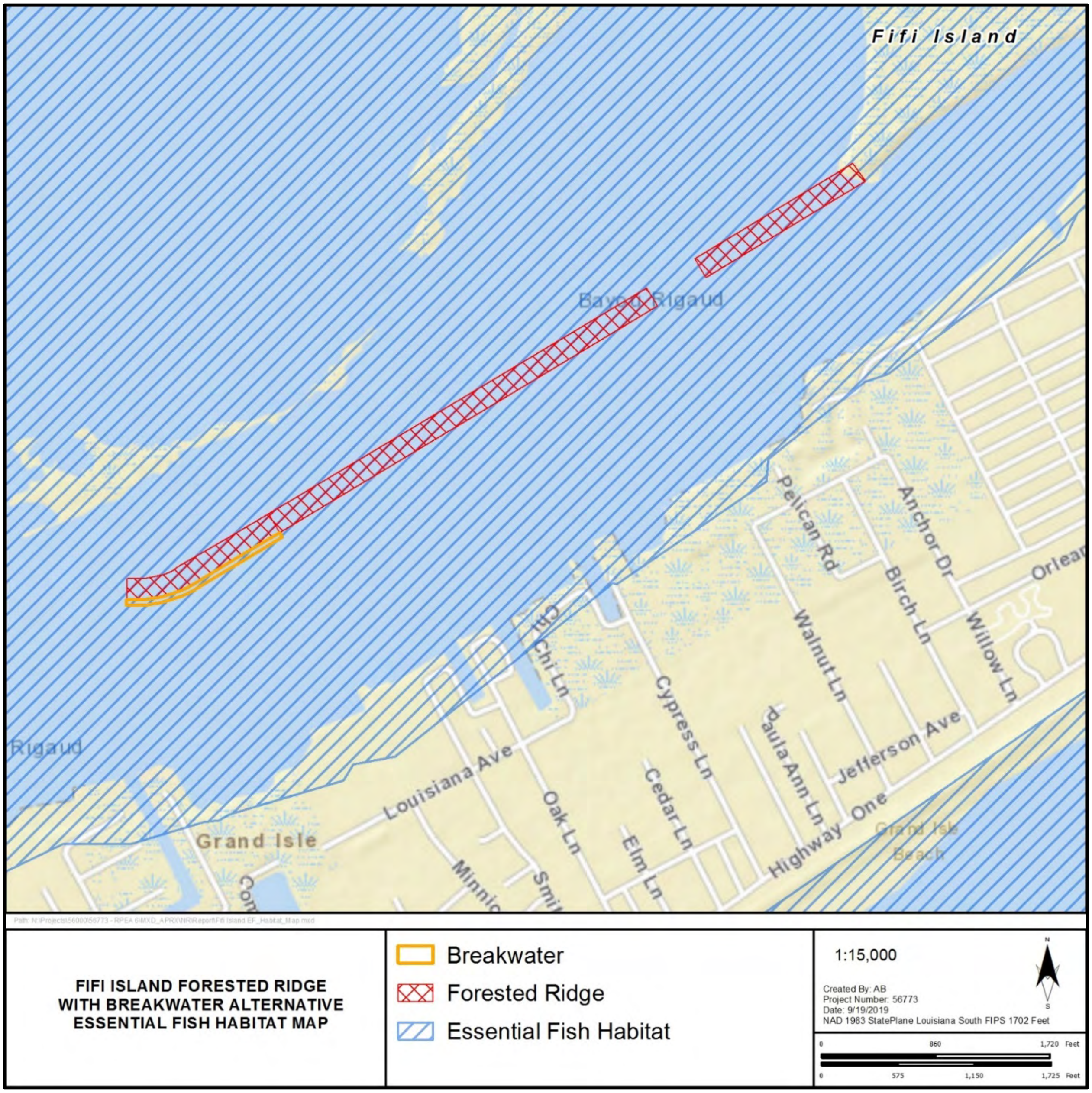

Figure 4.5-1. Essential fish habitat within the Fifi Island Forested Ridge with Breakwater alternative.

The timing of in-water, noise-producing activities would be planned to minimize disturbances to marine life. Potential impacts to estuarine and aquatic fauna and EFH would be considered and avoided or minimized to the extent practicable during design and construction.

4.5.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of Jefferson Parish. The list of species listed as threatened or endangered within Jefferson Parish with the potential to be present within the alternative is the same as those described for West Grand Terre and described in Table 4.2-2.

Piping plover designated critical habitat is present on Grand Isle adjacent to the alternative (see Figure 4.2-2). Piping plover designated critical habitat is located all along the southeastern shoreline of Grand Isle (Unit LA-5) approximately 0.75 mile southeast of Fifi Island. This designation applies to suitable overwintering habitats on the beaches, mudflats, and estuarine wetlands abutting and adjacent to the Gulf of Mexico. Primary constituent elements for piping plover overwintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. The elements include intertidal flats, including sand and/or mudflats with no or very sparse emergent vegetation, and adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide, which are important for roosting plovers.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents the estuarine area near Fifi Island; therefore, this species may be present near the alternative (Hayes et al. 2019).

Bald eagles are known to breed and winter near the alternative.

Environmental Consequences

Potential temporary adverse and long-term beneficial impacts to protected species as a result of the Fifi Island alternative would be similar to those described for West Grand Terre (see Section 4.2.2.4); however, because the alternative does not propose beach nourishment activities, potential impacts to loggerhead sea turtle nesting habitat and piping plover (including designated critical habitat) and red knot would not be anticipated.

4.5.3 Socioeconomic Resources

4.5.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Fifi Island alternative is located within Jefferson Parish, Louisiana, and within Census tract 279.02. Socioeconomic data for this area are described for the West Grand Terre alternative in Section 4.2.3.1. Because minority and low-income populations in Census tract 279.02 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Fifi Island alternative would not result in short- or long-term socioeconomic impacts because the alternative does not require displacements or demographic shifts from implementation of the alternative and the proposed activities would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparently and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

The Census tract overlapping with the alternative is not identified as an environmental justice population. Furthermore, if members of an environmental justice population outside of the Census tract referenced above engages in subsistence fishing in or near Fifi Island, the fishing opportunities would continue in adjacent areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally or adversely affected by construction and implementation of the Fifi Island alternative.

4.5.3.2 CULTURAL RESOURCES

Affected Environment

A marine archaeological investigation was conducted within the Fifi Island alternative on behalf of the USACE for proposed dredging, marsh creation, and breakwater construction along Bayou Rigaud near Fifi Island (Pelletier et al. 2005). R. Christopher Goodwin and Associates, Inc. conducted the survey in the fall of 2002 and spring of 2003. Overall, approximately 741 acres was investigated using a marine magnetometer, side-scan sonar, and a fathometer. Survey Block 4 (Fifi 3), measuring approximately 51.4 acres and Survey Block 6 (MOD), measuring approximately 197 acres, intersect the Fifi Island alternative (Pelletier et al. 2005: 2). The survey identified six magnetometer and/or side-scan sonar targets (Targets 147, 149, 154, 177, 178, and 179) that intersect the alternative (Pelletier et al. 2005: 100). Based on the results of the investigation, the original investigators concluded that all six of these targets consisted of modern debris scatters or buried pipelines, none of which were considered to be significant submerged cultural resources and none of which were recommended for further investigations (Pelletier et al. 2005: 145–153, 161–169). No direct investigations (probing) of any targets were conducted as part of the alternative, and no evaluation of submerged paleolandscapes was included in the analysis.

Based on this previous work, it appears that no cultural resources eligible for the NRHP are present within the alternative.

Environmental Consequences

Because no historic cultural sites or materials have been identified within the alternative, the Fifi Island alternative is anticipated to result in no impacts to cultural resources. BMPs listed in Appendix C would also be followed during E&D to avoid impacts to cultural resources. Consultation with the Louisiana SHPO and tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative.

4.5.3.3 INFRASTRUCTURE

Affected Environment

Fifi Island is uninhabited so there is limited infrastructure on the island. Similar to West Grand Terre, there is no public infrastructure on Fifi Island. There are a few pipelines within the alternative. There is a 20-inch Chevron pipeline along Fifi Island, immediately adjacent to the existing breakwater. There is also a submerged waterline for Jefferson Parish that crosses the alternative and crosses Fifi Island coming from Grand Isle. Across Bayou Rigaud on Grand Isle is some industrial development approximately 0.10 mile from Fifi Island.

Environmental Consequences

Construction of the Fifi Island alternative would result in short-term, minor adverse impacts to infrastructure. There would be no long-term adverse impacts to infrastructure. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure that traverses the alternative. Potential impacts may include unintended interruptions to service and outages as well as reduced access for the utilities to conduct maintenance activities. Impacts to utilities and public service would likely be localized and within operational capacities. The ridge would be constructed over a buried 20-inch Chevron pipeline, which follows the length of the proposed ridge location. This pipeline is estimated to be at least 6 feet below the water line and would be protected during construction (Averill 2019). To minimize potential impacts during construction, BMPs, including those discussed in Appendix C under Infrastructure, would be implemented to avoid impacts to infrastructure. The contractor would coordinate authorized activities with the pipeline owners prior to construction. Although construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure in the alternative, there would be no long-term adverse impacts to infrastructure as a result of the alternative.

4.5.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

Fifi Island is located within Jefferson Parish, Louisiana, and within the Jefferson Parish CZM Program and Grand Isle Management Unit, as described for the West Grand Terre alternative in Section 4.2.3.4. In addition, the alternative is included in the 2017 coastal master plan (CPRA 2017a) for restoration of barrier islands. On Grand Isle near Fifi Island is Sand Dollar Marina, which is approximately 0.25 mile away and serves as a marina, restaurant, and hotel. On Grand Isle near the northern part of Fifi Island is a USCG Station Grand Isle, which encompasses 29 acres and 25,000 square feet of operational and multi-purpose buildings. The USCG station serves as critical infrastructure for the safety of the surrounding area (FEMA 2012). The alternative would occur primary on state-owned bottom waters. Louisiana's State Water Bottom Management (as defined in Louisiana RS 41:1701–1714, revised January 2003) provides for the permitting and leasing of structures and facilities on non-eroded waterways and for reclamation and fill of non-eroded areas. It also requires permits and leases to construct and maintain bulkheads and flood-protection structures on navigable water bottoms. The State of Louisiana owns the beds and bottoms of many waterways where the ownership generally extends to the average low water shoreline in rivers and other streams. The ownership in most lakes, bays, sounds, and similar waterbodies and in the Gulf of Mexico extends to the mean high-water line. Work planned in state-owned water bottoms requires coordination with the Louisiana Office of State Lands, Division of Administration.

Environmental Consequences

This alternative would result in no short-term or long-term adverse impacts to land and marine management. Implementation of the Fifi Island alternative would also result in long-term benefits to land and marine management. The alternative is consistent with the goals of state, parish, and local coastal management plans, particularly with respect to consistency with restoration and protection objectives. The alternative would require modifications to an existing USACE permit (MVN 2014-0433 EMM) and CUP (P20140028), which allows placement of approximately 6,000 linear feet of rock dikes in open water. A portion of the rock dike that was permitted has been constructed, and the permit holders have already received a time extension (Jefferson Parish Coastal Management Department 2019). The alternative would comply with land use regulatory codes, would not adversely impact nearby or adjacent land uses and zoning, and would not represent an incompatible land use with near and adjacent uses. Therefore, the alternative would not result in any changes to land and marine management because the alternative would be consistent with the current parish and coastal management, practices, and plans. The alternative would also assist Jefferson Parish in achieving CZM goals of protecting and improving shorelines.

4.5.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

Because of the uninhabited nature of Fifi Island, there are limited opportunities for tourism and recreational use. Similar to West Grand Terre in Section 4.2.3.5, the waters around the island provide opportunities for recreational angling but do not provide attractions for recreational snorkeling or SCUBA diving. Recreationally important fish species such as spotted seatrout, red drum, black drum, and southern flounder use the barrier island habitats and are the target species for anglers. Grand Isle State Park and Sand Dollar marina are close to the island and support other recreational boating activities (FEMA 2012).

Environmental Consequences

The alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction areas. There would also be long-term beneficial impacts to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreationists from interruptions to recreational activities or visual interference or obstruction at Grand Isle State Park and/or Sand Dollar from construction. These short-term adverse impacts to recreation and tourism would be limited to the construction period and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreation through habitat restoration and creation along Fifi Island. Shoreline protection features could provide important habitat for migratory birds and assist species and types of habitats directly impacted by the DWH Oil Spill, which could result in increased recreational opportunities for users. The temporary construction impacts would be offset by the potential long-term benefits to tourism and recreation from the creation of coastal habitat and the forested ridge.

4.5.3.6 FISHERIES AND AQUACULTURE

Affected Environment

Fisheries and aquaculture for this area are as described for the West Grand Terre alternative in Section 4.2.3.1. The Sand Dollar Marina also supports economically important commercial and recreational fishing industry (FEMA 2012).

Environmental Consequences

The Fifi Island alternative would have short-term, minor adverse impacts to fisheries during construction, but long-term benefits to fisheries and aquaculture would occur. The noise and increased turbidity of surface waters arising from earth-moving activities during alternative construction could cause a temporary dispersal of mobile fish and shellfish from resulting in a minor, temporary impact. Colonization of the rock breakwaters by existing populations of fish and benthic organisms would be expected within a few weeks or months. Rock breakwater habitat would allow for a more diverse habitat than open waters, and the creation of breakwaters would be expected to benefit local managed fisheries. During construction, a few fisherman or businesses could be affected; however, these impacts would be small and localized and not expected to substantially alter social or economic conditions for commercial fisherman or the industry within the alternative. In the long term, the alternative would benefit fisheries and aquaculture by slowing the erosion of marsh, which could provide benefits to fishery resources in the form of new habitat and spawning grounds near Grand Isle because saltwater marsh habitat is highly productive for a variety of marine fishes and invertebrates.

4.5.3.7 MARINE TRANSPORTATION

Affected Environment

Fifi Island is easily accessible by boat from Grand Isle, which is located across Barataria Pass to the west. The island is only accessible by boat. Barataria Pass is a deep tidal inlet that is managed as part of the BWW for navigation by the USACE. Fifi Island serves as a wave break to protect the Bayou Rigaud navigational channel and the northeast shoreline of Grand Isle from wave action when severe weather from the north produces high-energy waves in Barataria Bay (FEMA 2012).

Environmental Consequences

The alternative could result in short-term, minor adverse impacts to marine transportation during construction, but no long-term adverse impacts to marine transportation would occur. The alternative is unlikely to impact marine transportation because current marine transportation levels in the area are low. Construction of the ridge and breakwater may cause short-term, minor adverse interference to navigation. There could be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. The temporary access channel and ridge would not impede existing navigation channels or marine transportation. The creation of the ridge and breakwater would not result in long-term impacts to marine transportation because they would not interfere with or impede marine transportation routes.

4.5.3.8 AESTHEICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. A view refers to a direct and unobstructed line-of-sight to an on- or off-site aesthetic resource, which may take the form of panoramic viewpoints from particular vantages. Existing views may be obstructed or blocked by modifications to the environment (e.g., grading, landscaping, and building construction).

Fifi Island is uninhabited, and much of it is surrounded by existing breakwaters. There are opportunities for public viewing of the Fifi Island alternative from boat users as well as from the residences, marinas, and public docks located on the bay side (west) of Grand Isle. Currently from this vantage point, viewers would see undeveloped, open marshy lands across the bay with approximately 1,400 feet of existing rock dike constructed along the Fifi Island coast. Vegetation and topography in the Grand Isle and Fifi Island allow for long-distance views to the alternative. The current viewshed is characterized as an undeveloped natural area along the water.

Environmental Consequences

The Fifi Island alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction; however, long-term benefits to aesthetics and visual resources would be expected. Modifications to the existing environment may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective.

Viewers would be able to see much of the forested ridge from locations on the bay side of Grand Isle. The public would also be able to see portions of the restoration area from the open water of Bayou Rigaud, between Fifi Island and Grand Isle. During construction, impacts to visual resources from the alternative would be adverse, moderate, and short term because of the presence of construction personnel, equipment, vehicles, and partially completed shoreline habitat and forested ridge. After construction, the alternative would result in an improvement to visual resources and aesthetics because the back-barrier marsh and protected beach would create a diversity of natural landscape elements within the viewshed. The breakwaters and ridge creation could assist in restoring visual resources to previous shoreline conditions. Furthermore, the creation of the new coastal habitat and the ridge would be perceived as a moderate beneficial visual impact and could result in an improved viewshed for viewers. New habitat is anticipated to attract additional birds and wildlife, thereby adding to the enjoyment of the area by recreational users and the general public. Beneficial impacts to aesthetics and visual resources from the alternative would be moderate and long term.

4.5.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

A reference search for records of hazardous waste locations was made, and no such records were found (FEMA 2012). Over the years, Fifi Island has experienced rapid land loss, especially on its eastern tip, leaving the Bayou Rigaud navigation channel and the northeast shoreline of Grand Isle unprotected (FEMA 2012). Information about flood and shoreline loss for Fifi Island is similar to West Grand Terre as discussed in Section 4.2.3.9.

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may occur during construction of the Fifi Island alternative, but no long-term adverse impacts to public health and safety would occur. Construction projects involving the use of boats, barges, and associated equipment for the placement of materials to create habitat could cause oil, fuel, or hazard material spills in surface waters, resulting in short-term, minor adverse impacts. Construction contractors are required to implement BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, to prevent oil, fuel, or other hazardous substances from entering the air or water. Construction contractors are also required to have a spill contingency plan for hazardous, toxic, or petroleum products in place to be implemented in the unlikely event of an occurrence. Because of the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water-related accidents and conflicts are minimized. There would be no long-term impacts to public health and safety from the alternative.

There would be no short-term adverse impacts to flood and shoreline protection during construction of the Fifi Island alternative, and long-term benefits to flood and shoreline protection would result. The alternative would result in the creation of 22 acres of new habitat and 6,000 linear feet of forested ridge on Fifi Island to protect Grand Isle and other barrier islands from storm surges. The coastal ridge would serve as a barrier to protect against impacts on Louisiana's only accessible and inhabited barrier island by reducing storm surge in Caminada Bay. Previous storms have demonstrated that a forested ridge on Fifi Island protects infrastructure on Grand Isle during a storm, especially when winds and surge come from the north. The alternative may decrease the risk of potential hazards (e.g., decreased likelihood of storm surge) to visitors, residents, and workers from increased shoreline integrity, which would be temporary and localized. The alternative would also provide benefits to coastal populations and infrastructure through improved shoreline protection, thereby improving coastal resiliency and providing a long-term beneficial impact to flood and shoreline protection.

4.6 No Action Alternative

Section 1502.14(d) of the Council on Environmental Quality (CEQ) regulations requires the alternatives analysis to "include the alternative of No Action." The CEQ states that in some cases "No Action" is "no change" from current management direction or level of management intensity. Therefore, the No Action Alternative may be thought of in terms of continuing with the present course of action until that action is changed. Impacts of proposed actions would be compared to those impacts for the existing actions. Under the No Action Alternative, the LA TIG would not, at this time, select and implement the alternatives related to wetlands, coastal, and nearshore habitats in this RP/EA intended to compensate for lost natural resources or their services resulting from the DWH Oil Spill. Accordingly, the No Action Alternative would not meet the purpose and need for implementing alternatives that address lost natural resources and their services as described in Section 5.3.2 of the Final PDARP/PEIS and in Section 1.5 of this RP/EA. The No Action Alternative would not meet the DWH Trustees' goals of restoring a variety of interspersed and ecologically connected coastal habitats to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities. If this plan is not implemented, none of the alternatives would be selected for implementation, and restoration benefits and services associated with these alternatives would not be achieved at this time.

4.6.1 Physical Environment

4.6.1.1 GEOLOGY AND SUBSTRATES

The No Action Alternative would not have any direct adverse effects to geology, soils, or substrates because it would not involve any activities (construction, structure placement, etc.) that could result in effects; however, ongoing coastal erosion would likely continue unabated resulting in long-term minor adverse impacts. The No Action Alternative would not result in any beneficial effects to geology, soils, or substrates that may occur from implementation of some of the alternatives; these beneficial effects include features that would prevent or reduce existing erosion conditions (e.g., breakwater, ridge and marsh restoration features that help reduce coastal erosion).

4.6.1.2 HYDROLOGY AND WATER QUALITY

The No Action Alternative would not result in direct adverse effects to hydrology or water quality because it would not involve any activities that could affect these resources. However, ongoing water quality effects from coastal erosion would likely continue unabated resulting in long-term minor adverse impacts. The No Action Alternative would not result in any beneficial effects to hydrology and water quality that may occur as a result of implementation of the alternatives. The alternatives are intended to reduce erosion and sedimentation from entering receiving waterbodies and to improve overall hydrologic cycling in the nearshore environment, which would benefit water quality. Additionally, infrastructure features in the alternatives would result in reducing long-term erosion and sedimentation of receiving waterbodies (e.g., placement of breakwaters, forested ridge and marsh creation to reduce erosion in coastal areas). These benefits would not be realized under the No Action Alternative.

4.6.1.3 AIR QUALITY

The No Action Alternative would have no effect on air quality or GHGs because no activities that have potential emissions would occur.

4.6.1.4 NOISE

There would be no noise effects as a result of the No Action Alternative because no noise-producing activities would be proposed.

4.6.2 Biological Environment

4.6.2.1 HABITATS

The No Action Alternative would not result in direct effects to terrestrial, coastal, nearshore, or marine habitats because no restoration activities would occur under the alternative. Alternatives considered under this RP/EA may benefit habitats by reducing erosion and land loss in coastal areas and increasing available high-quality habitats. Under the No Action Alternative, potential benefits to these habitats would not occur.

4.6.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

The No Action Alternative would not result in direct effects to terrestrial wildlife or migratory birds because no activities would occur under the alternative. Some alternatives may have indirect benefits to wildlife and birds, particularly those alternatives that result in reducing erosion and land loss in coastal areas such as beaches that provide habitat for many species. Marsh creation in nearshore habitats from the alternatives would benefit wildlife and migratory birds by improving areas for feeding and resting. Under the No Action Alternative, potential benefits to wildlife and migratory birds would not occur.

4.6.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

The No Action Alternative would not result in direct effects to marine and estuarine fauna because no activities would occur under the alternative. Some alternatives may have indirect benefits to these species, particularly alternatives that result in reducing erosion and sedimentation of waterbodies that provide habitat for coastal, nearshore, marine, and estuarine species. Under the alternatives, marsh creation would improve areas that may be presently used by marine and estuarine fauna for feeding, breeding, or resting. Under the No Action Alternative, potential benefits to these coastal, nearshore, marine, and estuarine species would not occur.

4.6.3.2.1 Protected Species

Protected Aquatic Species

The No Action Alternative would not result in direct effects to protected aquatic species because no activities would occur under the alternative. Some alternatives may have indirect benefits to protected aquatic species by reducing erosion and improving habitat quality. In addition, creation of marsh habitats under the alternatives would provide habitat for protected aquatic species by improving water quality and by increasing available habitat upon which some protected aquatic species (such as Gulf sturgeon) rely on for foraging, spawning, and resting. Under the No Action Alternative, potential benefits to these protected aquatic species would not occur.

Protected Terrestrial Species

The No Action Alternative would not result in direct effects to protected terrestrial species because no activities would occur under the alternative. Some alternatives may have indirect benefits to protected terrestrial species by reducing land loss in coastal areas such as beaches that provide habitat for piping plover and red knot. In addition, creation of beach and marsh habitats would provide habitat for protected terrestrial species by increasing available habitat for foraging and resting upon which protected terrestrial species may rely. Under the No Action Alternative, potential benefits to protected terrestrial species would not occur.

4.6.3 Socioeconomic Environment

4.6.3.1 SOCIOECONOMIC RESOURCES AND ENVIRONMENTAL JUSTICE

The No Action Alternative would have no effect on socioeconomic resources or environmental justice communities. The alternatives could result in small benefits to the local economy as a result of temporary construction jobs.

4.6.3.2 CULTURAL RESOURCES

There would be no effect to cultural resources as a result of the No Action Alternative because no activities which could affect cultural resources are proposed.

4.6.3.3 INFRASTRUCTURE

The No Action Alternative may result in long-term, minor adverse impacts to infrastructure as a result of ongoing coastal erosion and land loss. Many of the alternatives include activities to address coastal land loss and erosion that may affect infrastructure in the future. Under the No Action Alternative, potential benefits to infrastructure from alternatives that would provide protection to coastal areas would not occur, and these potential benefits would not be realized.

4.6.3.4 LAND AND MARINE MANAGEMENT

There would be no effect to land use or agricultural resources as a result of the No Action Alternative. Many of the alternatives include activities on existing agricultural lands intended to improve those resources and overall management. Under the No Action Alternative, these improvements would not be realized.

4.6.3.5 TOURISM AND RECREATIONAL USE

The No Action Alternative would have no effect on tourism and recreational use including fishing and hunting. Some of the alternatives could result in improved recreational access and use. Under the No Action Alternative, these recreational use benefits would not be realized.

4.6.3.6 FISHERIES AND AQUACULTURE

Under the No Action Alternative, no direct impacts to fisheries and aquaculture would occur because no activities would occur. Benefits from alternatives including placement of structure such as breakwaters and improved habitat in MCAs that could benefit fisheries would not occur nor would placement of the oyster reef. Under the No Action Alternative, these benefits would not be realized.

4.6.3.7 MARINE TRANSPORTATION

The No Action Alternative would not result in any impacts to marine transportation. Impacts from the alternatives to marine transportation from placement of breakwaters and oyster reefs would occur, but these effects are not substantial and NAVAIDS would be placed to alert vessel operators of their presence.

4.6.3.8 AESTHETICS AND VISUAL RESOURCES

The No Action Alternative would not alter any of the existing conditions at any of the alternatives. There would be temporary visual impacts from construction of alternatives, and some features would be visible from nearby areas (the breakwater, forested ridge, oyster reef, etc.). However, these effects would not be adverse.

4.6.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

The No Action Alternative may result in long-term, minor adverse impacts to public health and safety because of the ongoing coastal erosion and land loss. The alternatives may provide benefits to coastal populations and infrastructure through improved shoreline protection, thereby improving coastal resiliency to the local areas where alternatives would be implemented. Under the No Action Alternative, these potential benefits to public health and safety would not be realized.

4.7 Comparison of Impacts of the Alternatives

The alternatives would result in some adverse impacts to several environmental resources, mainly during construction. Most of these adverse impacts are expected to be short term and minor.

Long-term impacts to several of the environmental resources are expected to be beneficial because hydrology and water quality, terrestrial habitats, and land use components would be improved with implementation of the alternatives.

A summary of the environmental consequences for each resource for each alternative and the No Action Alternative is provided in Table 4.7-1.

Table 4.7-1. Comparison of Impacts for the Alternatives and No Action Alternative

Alternatives	Physical Resources				Biological Resources				Socioeconomic Resources								
	Geology and Substrates	Hydrology and Water Quality	Air Quality	Noise	Habitats	Wildlife Species (including birds)	Marine and Estuarine Fauna (fish, shellfish, benthic organisms)	Protected Species	Socioeconomics and Environmental Justice	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety (including flood and shoreline protection)
No Action	l -	l -	NE	NE	NE	NE	NE	NE	NE	NE	l -	NE	NE	NE	NE	NE	l -
West Grand Terre Beach Nourishment and Stabilization	s +	s +	s	s	s l +	s +	s l +	s +	NE	C	s	+	s +	s +	s	s +	s +
Golden Triangle Marsh Creation	s +	s +	s	s	s l +	s +	s l +	s +	NE	C	s	+	s +	s +	s	s +	s +
Biloxi Marsh Living Shoreline	s +	s +	s	s	s l +	s +	s +	s +	NE	C	s	+	s +	s +	s	s +	s +
Fifi Island Forested Ridge with Breakwater	s +	s +	s	s	s l +	s +	s +	s +	NE	C	s	+	s +	s +	s	s +	s +

Notes:
Adverse effect: -
Beneficial effect: +
Short-term minor adverse effect: s
Short-term moderate adverse effect: <u>S</u>
Short-term major adverse effect: **<u>S</u>**
Long-term minor adverse effect: l
Long-term moderate adverse effect: <u>L</u>
Long-term major adverse effect: **<u>L</u>**
No effect: NE
C: Consultation with the Louisiana SHPO to determine any additional requirements may be necessary if any ground-disturbing activities are proposed outside the existing infrastructure footprints under the alternative.

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4.8 Preferred Alternatives

As discussed in Section 3.1.1, alternatives were initially screened based on OPA-defined criteria. Alternatives were also analyzed, per NEPA, to determine the type and severity of potential environmental impacts that could result from the implementation of the alternatives.

The OPA and NEPA analyses were conducted for the reasonable range of four wetlands, coastal, and nearshore habitat restoration alternatives that would provide benefits to the physical environment, biological environment, and socioeconomics resources. Although there would be minor to moderate adverse effects to water quality, geology, recreation, marine transportation, fisheries, wildlife, and protected species, these effects would be short term and would not persist after construction is completed. Therefore, the preferred alternatives can be implemented without causing substantial adverse impacts. Ultimately, the LA TIG identified alternatives that are preferred for implementation in this Draft RP/EA based on the OPA evaluation of cost-effectiveness, likelihood of success, and scale of the restoration benefits. The Fifi Island Forested Ridge with Breakwater Alternative is small in scale (22 acres) in comparison to the West Grand Terre, Golden Triangle, and Biloxi March alternatives; therefore, the net benefits are also smaller in scale.

As a result of the OPA evaluation, three alternatives are proposed by the LA TIG as preferred for implementation (Table 4.8-1). As stated in the Final PDARP/PEIS, the No Action Alternative “does not meet the purpose and need for restoration of injured resources and services” and therefore is not identified as a preferred alternative.

Table 4.8-1. Preferred Alternatives

West Grand Terre Beach Nourishment and Stabilization
Golden Triangle Marsh Creation
Biloxi Marsh Living Shoreline

5 CUMULATIVE IMPACTS

5.1 Introduction

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertake such other actions" (40 CFR 1508.7). The CEQ regulations to implement NEPA require the assessment of cumulative impacts be taken into consideration in the decision-making process for federal projects, plans, and programs. Cumulative impacts need to be analyzed in a meaningful manner that considers the specific resource, ecosystem, and human community being affected by the alternatives and should be considered for all alternatives, including the No Action Alternative (CEQ 1997).

The cumulative impacts analysis conducted for this RP/EA is consistent with CEQ regulations and considers the environmental impacts of the alternatives when added to impacts of past, present, and reasonably foreseeable future actions in each alternative's impact zone.

5.1.1 Discussion of Regional Restoration Programs

The goals of this cumulative analysis are to support the determination of each alternative's ability to meet the purpose and need for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitat restoration type, as described in Section 1.4, Restoration Purpose and Need. The methods and resources used for the Final PDARP/PEIS cumulative analysis (Section 6.6, Cumulative Impacts) serve as the basis for this cumulative analysis and are incorporated by reference. In addition, the Final PDARP/PEIS informed the general anticipated impacts and benefits from different restoration project types that may combine with impacts and benefits from construction and implementation of each alternative analyzed in this RP/EA.

The Final PDARP/PEIS analyzes regional restoration projects and programs specific to the Gulf Coast region of Louisiana as well as other actions for consideration in cumulative impacts (PDARP/PEIS Appendix 6.B Additional Actions for Consideration in Cumulative Impacts Analysis). These actions include Habitat Conservation and Protection Programs, Restoration Programs, Water Quality Improvement projects, Military Activities and Projects, Shipping and Maritime Port Projects, Tourism and Recreational Programs, Dredged Material Disposal Projects, and Outer Continental Shelf Projects. Regional restoration projects and programs are expected to result in cumulative and synergistic beneficial effects to coastal habitats across the Gulf Coast and were analyzed on a programmatic level in the Final PDARP/PEIS. This RP/EA is tiered from that programmatic analysis, and the intent of this analysis is to focus on a narrower set of specific projects (alternatives) and provide an analysis of cumulative impacts that would be applicable to the Restore and Conserve Wetlands, Coastal, and Nearshore Habitat restoration type. The multistep approach used for evaluating cumulative impacts for this RP/EA is consistent with the methodology used in the Final PDARP/PEIS and subsequent documents and is described below.

5.1.2 Methods for Assessing Cumulative Impacts

The analysis of potential cumulative impacts from the alternatives described in this RP/EA was completed through the following four steps, which are based on the methods used in Section 6.6, Cumulative Impacts of the Final PDARP/PEIS.

> **Step 1: Identify Resources.** In this step, resources that would be directly or indirectly impacted or benefited by each of the alternatives, as described in Section 4,

Environmental Assessment, were identified. These impacted resources are carried forward for the cumulative impact analysis of each alternative. Resources that are not present in the alternative or are not impacted by implementation of an alternative were not carried forward for cumulative impact analysis. Resources carried forward or excluded from analysis are described for each alternative below.

Step 2: Establish Boundaries. Consistent with CEQ guidance (CEQ 1997), spatial and temporal boundaries must be established to capture resources that would be affected by past, present, and reasonably foreseeable future actions in combination with each of the alternatives for consideration in the cumulative impact analysis. For this analysis, a 1-mile buffered spatial area around each alternative was selected to capture the magnitude and extent of impacts that would be expected from these types of projects (Figure 5.1-1). This buffered area was selected through a review of cumulative impacts analysis areas (CIAAs) defined in previously published RP/EAs, agency consultation, and subject matter expert input. The existing conditions from which this analysis is based, as described in Section 4, Environmental Assessment, captures projects that have occurred in the past that may lead to impacts on resources within the CIAAs. Therefore, the temporal boundary for this cumulative impact analysis is approximately 12 years from the signing of this RP/EA decision, to capture present and future actions that could occur within the estimated remaining time remaining approved funding would be available for Restore and Conserve Wetlands, Coastal and Nearshore Habitat alternatives.

Step 3: Identify Cumulative Action Scenarios. The cumulative action scenarios describe the types of past, present, and reasonably foreseeable future actions (projects) that are included in the cumulative impact analysis for each affected resource identified under an alternative and the anticipated impacts and benefits from these projects. These projects fall within the spatial and temporal boundaries established for the analysis. For the purposes of this analysis, these projects are grouped consistent with the categories considered in the Final PDARP/PEIS and subsequent RP/EAs, as summarized in the Summary of Potential Impacts to Resources from Alternatives in this Restoration Plan and Environmental Assessment (Table 5.1-1) and detailed in Appendix F, Cumulative Action Scenario. Appendix F also includes detailed figures by alternative showing the location of projects described in the cumulative action scenarios. Table 5.1-1 includes impacts by resource and project type that are applicable to all alternatives, except where noted. Because actions are grouped by general project type, the impact assessment for each project reflects the types of short- and long-term impacts that can be expected from the activities generally associated with that type of action. There are no marine mineral mining or dredged material disposal projects within the CIAA for any alternative.

Step 4: Cumulative Impacts Analysis. The final step in the cumulative impacts analysis is determining the incremental impact of each alternative (X) in combination with impacts from applicable past, present, and reasonably foreseeable future actions (Y), therefore providing the potential cumulative impacts from each alternative and applicable actions on an affected resource (Z). Consistent with the Final PDARP/PEIS and subsequent RP/EAs, this is simply stated as X + Y = Z.

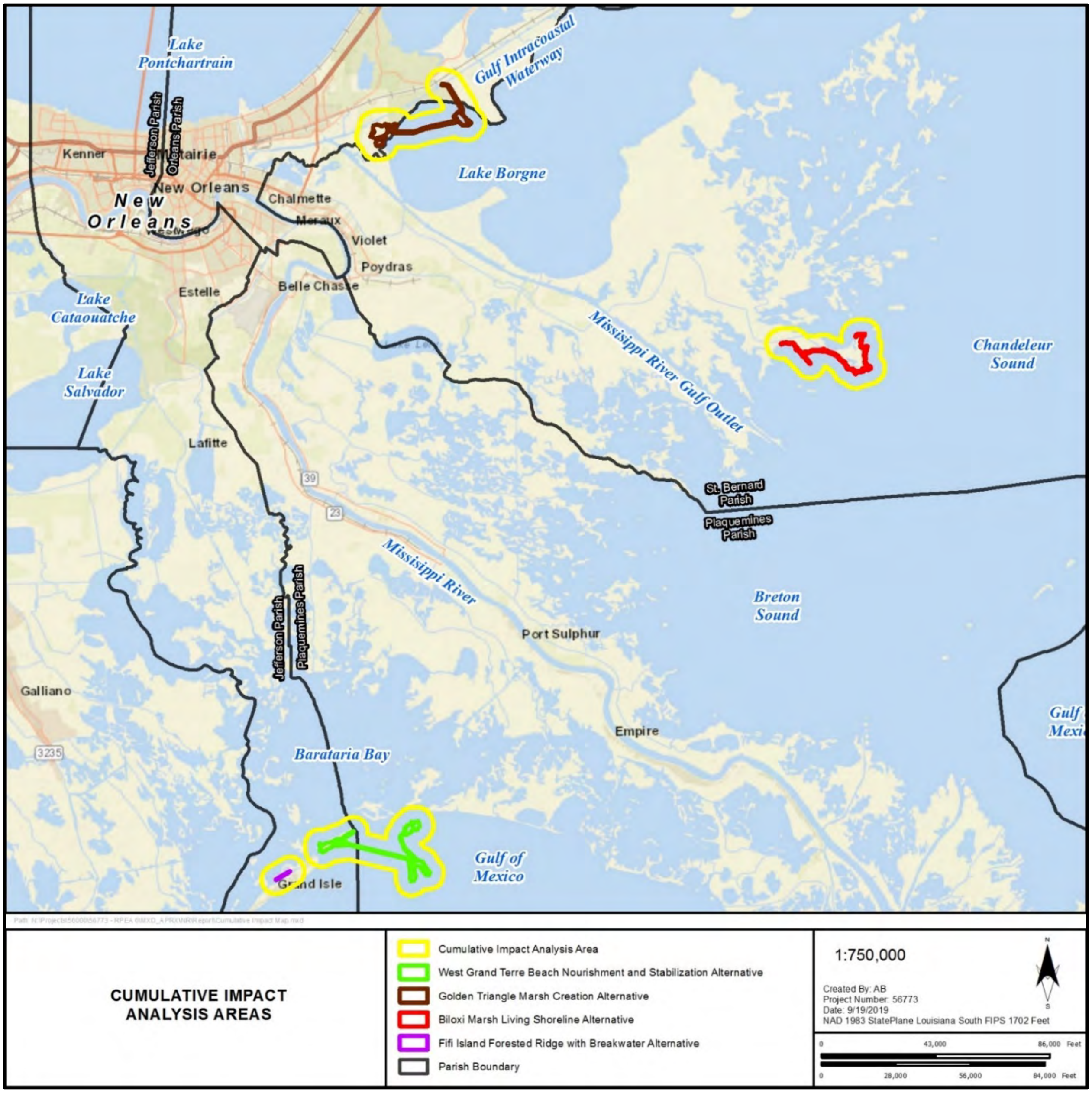

Figure 5.1-1. Cumulative impact analysis areas for all alternatives.

Table 5.1-1. Summary of Potential Impacts to Resources from Alternatives in this Restoration Plan and Environmental Assessment

Resource	Coastal Restoration and Improvements	Energy Activities	Tourism and Recreation
Physical Resources			
Geology and substrates	X	X	X
Hydrology and water quality	X	X	X
Air quality	X	X	X
Noise	X	X	X

Resource	Coastal Restoration and Improvements	Energy Activities	Tourism and Recreation
Biological Resources			
Habitats	X	X	X
Wildlife species (including birds)	X	X	X
Marine and estuarine fauna (fish, shellfish, benthic organisms)	X	X	X
Protected species	X	X	X
Socioeconomic Resources			
Socioeconomics and environmental justice*	X	X	X
Cultural resources†	X	X	X
Infrastructure	X	X	X
Land and marine management	X	X	X
Tourism and recreational use	X	X	X
Fisheries and aquaculture	X	X	X
Marine transportation	X	X	X
Aesthetics and visual resources	X	X	X
Public health and safety (including flood and shoreline protection)	X	X	X

* There are no significant areas of environmental justice populations and/or no disproportionate impacts on environmental justice populations for any of the alternatives, so this resource was not carried forward for cumulative analysis.

† There are no cultural resources identified for the Biloxi Marsh alternative or Fifi Island alternative, so this resource was not carried forward for cumulative analysis for these alternatives.

5.2 West Grand Terre Beach Nourishment and Stabilization Alternative

5.2.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the West Grand Terre alternative carried forward in the cumulative analysis are described in Section 4.2 with the exception of environmental justice for which a no effect determination was made.

5.2.2 Cumulative Impacts Analysis Area

The CIAA for the West Grand Terre alternative (see Figure 5.1-1 and Figure F-2 in Appendix F) includes portions of Jefferson Parish and Plaquemines Parish within the Barataria Basin, and the eastern-most portion of Grand Isle. Basin subsegments that fall within this CIAA include the Barataria Bay (subsegment 021101), Barataria Basin coastal bays and Gulf waters to state 3-mile limit (subsegment 021102), and Bay Sansbois and Lake Washington (subsegment 020907).

5.2.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the West Grand Terre alternative CIAA include CPRA and non-CPRA restoration projects for coastal development and land use, energy activities, and tourism and recreational resource improvements (Appendix F). The anticipated resources impacted from implementation of these projects are summarized in Table 5.1-1. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

Because of the nature of the projects detailed in Appendix F, many of which are restoration focused, impacts from their implementation would be limited in temporal and spatial scale. Most of these projects are located on or near barrier islands and in offshore waters, which include large uninhabited areas, thereby causing the greatest changes to physical and biological resources. Some projects, specifically those related to oil and gas, would result in the creation of permanent structures in the CIAA. As a result, long-term impacts from implementation of these projects could include changes to or degradations of geologic characteristics and substrates, hydrology, infrastructure, fisheries and aquaculture, and aesthetics and visual resources.

Projects focused on restoration could provide benefits to geology and substrates, hydrology and water quality, air quality, biological resources, socioeconomics, cultural resources, land and marine management, tourism and recreational use, fisheries and aquaculture, marine transportation, and aesthetics and visual resources. These benefits would result from actions that stabilize soils, sediments, and substrates; increase sediment deposition; restore hydrology; improve water quality; increase flood and shoreline protection; re-establish native plant communities; and implement habitat and tourism and recreation improvements.

5.2.4 Cumulative Impacts Analysis

The West Grand Terre alternative would result in short-term adverse impacts on all the physical, biological, and socioeconomic resources discussed in this RP/EA. Overall, the West Grand Terre alternative would result in an incremental beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the West Grand Terre alternative, within the CIAA are restoration focused and could result in synergistic effects (Appendix F). The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem and the West Grand Terre alternative would result in an incremental contribution to overall benefits within the CIAA when combined with other past, present, and reasonably foreseeable future actions.

5.3 Golden Triangle Marsh Creation Alternative

5.3.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Golden Triangle alternative carried forward for cumulative analysis are described in Section 4.3 with the exception of environmental justice for which a no effect determination was made.

5.3.2 Cumulative Impacts Analysis Area

The CIAA for the Golden Triangle alternative (see Figure 5.1-1 and Figure F-3 in Appendix F) includes portions of Orleans Parish and St. Bernard Parish within the Pontchartrain Basin. Basin subsegments that fall within this CIAA include Bayou Bienvenue (subsegment 042004), Lake Borgne (subsegment 042001), Intracoastal Waterway (subsegments 041601 and 041703), New Orleans East leveed waterbodies (subsegment 041401), and Bayou Sauvage (subsegment 041702). Census tracts within this CIAA include 17.34, 17.51, 302.04, 9801, and 9900.

5.3.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Golden Triangle alternative CIAA include CPRA and non-CPRA restoration projects for coastal development and land use, energy activities, and tourism and recreation (Appendix F). The anticipated resources impacted from implementation of these projects are summarized in Table 5.1-1. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

Because of the nature of the projects detailed in Appendix F, many of which are restoration and mitigation (including structural and hurricane protection) focused, impacts from their implementation would be limited in temporal and spatial scale. Most of these projects are along the coast and in offshore waters, thereby causing the greatest changes to physical and biological resources. Some projects, specifically those related to oil and gas, would result in the creation of permanent structures in the CIAA. As a result, long-term impacts from implementation of these projects could include changes to or degradations of geology and substrates, hydrology and water quality, infrastructure, marine transportation, fisheries and aquaculture, and aesthetics and visual resources.

Restoration projects could provide benefits to geology and substrates, hydrology and water quality, air quality, biological resources, socioeconomics, cultural resources, land and marine management, tourism and recreational use, fisheries and aquaculture, marine transportation, and aesthetics and visual resources. Restoration projects would also contribute to providing benefits to public health and safety through increased coastal resiliency and reduced risk from hurricanes and floods. These benefits would result from actions that stabilize soils, sediments, and substrates; increase sediment deposition; restore hydrology; improve water quality; increase flood and shoreline protection; re-establish native plant communities; and implement habitat and tourism and recreation improvements.

5.3.4 Cumulative Impacts Analysis

The Golden Triangle alternative would result in short-term adverse impacts on geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species and critical habitat, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, and public health and safety. However, these short-term impacts would be temporally and spatially limited, quickly becoming undetectable or unmeasurable. In addition, BMPs implemented as part of the alternative's design, as discussed throughout Section 4 of this analysis, would minimize or avoid short-term impacts.

Overall, the Golden Triangle alternative would result in an incremental beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the West Grand Terre alternative, within the CIAA are restoration focused and could result in synergistic benefits. The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem, and the Golden Triangle alternative would result in an incremental contribution to overall benefits within the cumulative analysis are when combined with other past, present, and reasonably foreseeable future actions.

5.4 Biloxi Marsh Living Shoreline Alternative

5.4.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Biloxi Marsh alternative carried forward for cumulative analysis are described in Section 4.4, with the exception of environmental justice for which a no effect determination was made and cultural resources, which were not found in the alternative.

5.4.2 Cumulative Impacts Analysis Area

The CIAA for the Biloxi Marsh alternative (see Figure 5.1-1 and Figure F-4 in Appendix F) includes portions of St. Bernard Parish within the Pontchartrain Basin, and the eastern half of Grand Isle. Basin subsegments that fall within this CIAA include the Bayou La Loutre MRGO to Eloi Bay (subsegment 042003), Eloi Bay (subsegment 042206), and Morgan Harbor (subsegment 042205).

5.4.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Biloxi Marsh alternative CIAA are the same as those described for the Golden Triangle alternative (see Section 5.3.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, the anticipated resources and impacts would be the same as those described for the Golden Triangle alternative. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

5.4.4 Cumulative Impacts Analysis

The Biloxi Marsh alternative would result in short-term adverse impacts on geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, and public health and safety. However, these short-term impacts would be temporally and spatially limited, quickly becoming undetectable or unmeasurable. In addition, BMPs implemented as part of the alternative’s design, as discussed throughout Section 4 of this analysis, would minimize or avoid short-term impacts.

Overall, the Biloxi Marsh alternative would result in a beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the Biloxi Marsh alternative, within the CIAA are restoration focused and could result in synergistic benefits. The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem, and the Biloxi Marsh alternative would result in an incremental contribution to overall benefits within the CIAA when combined with other past, present, and reasonably foreseeable future actions.

5.5 Fifi Island Forested Ridge with Breakwater Alternative

5.5.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Fifi Island alternative carried forward for cumulative analysis are described in Section 4.5, with the exception of environmental justice for which a no effect determination was made and cultural resources, which were not found in the alternative.

5.5.2 Cumulative Impacts Analysis Area

The CIAA for the Fifi Island alternative (see Figure 5.1-1 and Figure F-5 in Appendix F) includes portions of Jefferson Parish within the Barataria Basin, and the eastern half of Grand Isle. Basin subsegments that fall within this CIAA include the Barataria Bay (subsegment 021101) and Barataria Basin coastal bays and Gulf waters to state 3-mile limit (subsegment 021102).

5.5.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Fifi Island alternative CIAA are the same as those described for the West Grand Terre alternative (see Section 5.2.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, the anticipated resources impacted from implementation of these projects and impacts and benefits that could result from implementation of these projects would be similar to as those described for the West Grand Terre alternative. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

5.5.4 Cumulative Impacts Analysis

Impacts to resources as a result of the Fifi Island alternative would be the same as those described for the West Grand Terre alternative (Section 5.2.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, impact contributions of the Fifi Island alternative would be the same as the West Grand Terre alternative. Therefore, the Fifi Island alternative would provide incremental benefits to geology and substrates, hydrology and water quality, wetlands and floodplains, air quality, biological resources, and socioeconomics but would not substantially contribute to short- or long-term cumulative impacts on any resource when analyzed in combination with other past, present, and reasonably foreseeable future actions.

6 COMPLIANCE WITH OTHER LAWS AND REGULATIONS

In addition to the requirements of OPA and NEPA, other laws may apply to the alternatives in this Draft RP/EA. The LA TIG would ensure compliance with these relevant authorities, which are listed in Sections 6.1 and 6.2. Whether, and to what extent, an authority applies to a future alternative depends on the specific characteristics of a particular alternative and the presences of specific resources.

Examples of applicable federal and state laws or federal executive orders (EOs) include those listed in this section. Additional federal laws may apply to the alternatives considered in this Draft RP/EA. Legal authorities applicable to restoration alternative development are fully described in the context of the DWH restoration planning in the Final PDARP/PEIS, Section 6.9, Compliance with Other Applicable Authorities, and Final PDARP/PEIS Appendix 6.D, Other Laws and Executive Orders, which are incorporated by reference in this section.

Federal environmental compliance responsibilities and procedures follow the Trustee Council SOPs, which are laid out in Section 9.4.6 of that document (Trustee Council 2016). Following this SOP, the Implementing Trustees for each alternative will ensure that the status of environmental compliance (e.g., completed versus in progress) is tracked through the DWH project portal. The Implementing Trustees will keep a record of compliance documents (e.g., ESA letters, permits) and ensure that they are submitted for inclusion in the administrative record. The current status of environmental compliance by alternative can be viewed at any time on the Trustee Council's website (http://www.gulfspillrestoration.noaa.gov/environmental-compliance/).

6.1 Additional Federal Laws

Additional federal laws may apply to the preferred alternatives considered in this Draft RP/EA. Federal laws, regulations, and EOs that may be applicable include the following:

- ESA (16 USC 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801 et seq.)
- MMPA (16 USC 1361 et seq.)
- Coastal Zone Management Act (16 USC 1451 et seq.)
- National Historic Preservation Act (16 USC 470 et seq.)
- MBTA (16 USC 703 et seq.)
- BGEPA (16 USC 668 et seq.)
- Clean Air Act (42 USC 7401 et seq.)
- Federal Water Pollution Control Act (Clean Water Act) (33 USC 1251 et seq.) and/or Rivers and Harbors Act (33 USC 401 et seq.)
- Marine Protection, Research and Sanctuaries Act (16 USC 1431 et seq. and 33 USC 1401 et seq.)
- Estuary Protection Act (16 USC 1221–1226)
- Archaeological Resource Protection Act (16 USC 470aa–470mm)
- National Marine Sanctuaries Act (16 USC 1431 et seq.)
- Farmland Protection Policy Act (7 USC 4201–4209)

- Rivers and Harbors Act (33 USC 401 et seq.)
- EO 11988: Floodplain Management (augmented by EO 13690, January 30, 2015)
- EO 11990: Protection of Wetlands
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- EO 12962: Recreational Fisheries
- EO 13007: Indian Sacred Sites
- EO 13112: Safeguarding the Nation from the Impacts of Invasive Species
- EO 13175: Consultation and Coordination with Indian Tribal Governments
- EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- EO 13693: Planning for Federal Sustainability in the Next Decade

For the alternatives under this RP/EA, the LA TIG has requested initiation of the necessary consultations and reviews with the regulatory agencies.

6.2 State and Local Laws

The LA TIG would ensure compliance with all applicable state and local laws and other applicable federal laws and regulations relevant to the State of Louisiana. Additional laws and regulations are as follows:

- Archeological Finds on State Lands (RS 41:1605)
- Coastal Wetlands Conservation and Restoration Authority (RS 49:213.1)
- Coastal Wetlands Conservation and Restoration Plan (RS 49:213.6)
- Louisiana State and Local Coastal Resources Management Act (RS 49:214.21–214.42)
- Louisiana Oil Spill Prevention and Response Act (RS 30:2451 et seq.)
- Management of State Lands (RS 41:1701.1 et seq.)
- Louisiana Coastal Resources Program (Louisiana Administrative Code [LAC] 43:700 et seq.)
- Louisiana Surface Water Quality Standards (LAC 33.IX, Chapter 11)
- Management of Archaeological and Historic Sites (RS 41:1605)
- Oyster Lease Relocation Program (LAC 43:I, 850–859, Subchapter B)
- Louisiana Scenic Rivers Program (RS 56:1856)

6.3 Summary and Next Steps for Preferred Alternatives

The LA TIG would ensure compliance with all applicable state and local laws and other applicable federal laws and regulations relevant to the proposed restoration alternatives, including technical assistance from appropriate regulatory agencies, to identify any compliance issues. The LA TIG has started coordination and technical assistance reviews for protected species and their habitats under the ESA, for EFH protected under the Magnuson-Stevens Fishery Conservation and Management Act, for marine mammals under the MMPA, for migratory birds under the MBTA, for eagles under the BGEPA, for cultural resources under the National Historic Preservation Act, for permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, and for other federal statutes, where appropriate. CZMA consistency reviews have been completed for the three preferred alternatives. Early discussions indicate that formal ESA consultation with NMFS will be needed for the Golden Triangle preferred alternative due to proposed dredging within Gulf sturgeon designated critical habitat. The LA TIG would ensure that compliance reviews/approvals under all applicable state and local laws and other applicable federal laws and regulations relevant to the selected design alternative are complete before implementation.

Wherever pre-existing consultations or permits are present, they would be reviewed to determine if the consultations or permits are still valid or if a re-initiation of the consultations is necessary. Implementing Trustees are required to implement the BMPs included in Appendix C of this RP/EA as well as alternative-specific mitigation measures or terms and conditions identified through consultations or issuance of permits. Oversight, provided by the Implementing Trustees, would conduct due diligence with regard to ensuring no unanticipated effects to listed species and habitats occur, including ensuring that BMPs are implemented and continue to function as intended. A summary of environmental compliance status will be provided in the final Phase 2 RP/EA #6.

6.3.1 Preliminary Finding of No Significant Impact

In this RP/EA, the LA TIG addresses NEPA requirements by tiering from environmental analyses conducted in the Final PDARP/PEIS, evaluating existing analyses, and preparing environmental consequences analyses for the alternatives as appropriate. Based on the programmatic analysis provided by the Final PDARP/PEIS, consideration of the environmental consequences in this RP/EA, and the proposed mitigation measures, the LA TIG's preliminary findings indicate that the alternatives evaluated in this RP/EA would not result in any significant impacts on the human environment in accordance with the guidelines for determining the significance of proposed federal actions (40 CFR 1508.27). If, after public comments are addressed and the preliminary findings are confirmed, the LA TIG will issue a FONSI appended to the Final RP/EA.

6.4 Response to Public Comment

The RP/EA will be populated with a summary of the comments received and the responses to public comments during the Draft RP/EA public review period. The detailed response to public comments will be attached in an appendix to the Final RP/EA.

7 LIST OF PREPARERS AND REVIEWERS

Table 7.1-1. List of Preparers and Reviewers

Agency/Firm	Name
State of Louisiana	
Louisiana CPRA	Vida Carver
	Micaela Conor
	Caitlin Glymph
	Todd Folse
	James McMenis
	Chris Barnes
EPA	
EPA Office of Water	Tim Landers
EPA Region 6	Douglas Jacobson
	Patricia Taylor
EPA Office of General Counsel	James Bove
EPA Office of Water	Gale Bonanno
NOAA	
NOAA Restoration Center	Barrett Ristroph
	Christina Fellas
	Ramona Schreiber
	Courtney Schupp
NOAA	Jared Piaggione
DOI/USFWS	
DOI	Robin Renn
Contractor Team	
SWCA Environmental Consultants	Will Norman
	Whitney Fiore
	Coleman Burnett
	Chelsea Murphy
	Amanda Nicodemus
	Meggan Dugan
	Laura Klewicki
	Jen Wynn
	Linda Tucker Burfitt
	Kerri Linehan
	Debbi Smith

8 LIST OF REPOSITORIES

Table 8.1-1. List of Repositories

Library	Address	City	Zip Code
St. Tammany Parish Library	310 West 21st Avenue	Covington	70433
Terrebonne Parish Library	151 Library Drive	Houma	70360
New Orleans Public Library, Louisiana Division	219 Loyola Avenue	New Orleans	70112
East Baton Rouge Parish Library	7711 Goodwood Boulevard	Baton Rouge	70806
Jefferson Parish Library, East Bank Regional Library	4747 West Napoleon Avenue	Metairie	70001
Jefferson Parish Library, West Bank Regional Library	2751 Manhattan Boulevard	Harvey	70058
Plaquemines Parish Library	8442 Highway 23	Belle Chasse	70037
St. Bernard Parish Library	1125 East St. Bernard Highway	Chalmette	70043
St. Martin Parish Library	201 Porter Street	St. Martinville	70582
Alex P. Allain Library	206 Iberia Street	Franklin	70538
Vermilion Parish Library	405 East St. Victor Street	Abbeville	70510
Martha Sowell Utley Memorial Library	314 St. Mary Street	Thibodaux	70301
South Lafourche Public Library	16241 East Main Street	Cut Off	70345
Calcasieu Parish Public Library Central Branch	301 West Claude Street	Lake Charles	70605
Iberia Parish Library	445 East Main Street	New Iberia	70560
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9 LITERATURE CITED

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APPENDIX A

Notice of Solicitation of Project Ideas

NOTICE OF SOLICITATION OF PROJECT IDEAS

The Louisiana Trustee Implementation Group is planning restoration activities to address injuries caused by the *Deepwater Horizon* oil spill. We would like your input regarding natural resource restoration opportunities in Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes in Louisiana.

We will consider a range of restoration activities under the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type. More specifically, we will consider these restoration approaches under this restoration type:

- Create, restore, and enhance coastal wetlands,
- Restore oyster reef habitat,
- Create, restore, and enhance barrier and coastal islands and headlands, and
- Restore and enhance dunes and beach.

We will consider restoration project proposals that could be ready for construction within 12 to 18 months of your submission. To that end, specifically, we would like to identify projects for which environmental compliance and/or engineering and design are already underway.

You can find information on the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type, the four restoration approaches listed above, and the Oil Pollution Act criteria against which project ideas are being evaluated in the programmatic restoration plan and in the plan overview.

You may submit restoration project ideas for consideration to the Trustees or to the State of Louisiana. If you have submitted project ideas in connection with other Louisiana restoration planning efforts, including Louisiana's Coastal Master Plan and *Deepwater Horizon* restoration planning efforts, you do not need to resubmit those ideas. Instead, simply reference the method of and date of submittal of those previous project proposals, and we will consider them in this planning effort.

New or revised project ideas should be submitted through the Trustee portal or the Louisiana portal by July 5, 2019. Projects submitted after the deadline will be considered in future restoration planning efforts.

We will consider projects that address the listed restoration type/restoration approaches and may develop one or more draft restoration plans. We may also develop our own restoration projects for consideration.

Please contact us at LATIG@LA.gov if you have any questions. We look forward to considering your restoration project ideas.

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APPENDIX B

Project Universe

Table B-1. Project Universe: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat Restoration Type

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
Coalition to Restore Coastal Louisiana (CRCL)	Nearshore Oyster Reef Restoration in Barataria Basin Using Recycled Shell	The Coalition to Restore Coastal Louisiana (CRCL) proposes creating a nearshore living shoreline in Louisiana's Barataria Basin in an area highly suitable for oyster reef restoration and alongside marsh that would benefit from shoreline protection. Leveraging our existing Oyster Shell Recycling Program, CRCL will collect oyster shell from New Orleans-area restaurants and return it to our coastal waters as cultch. Recycled oyster shell and limestone will be placed into flexible Gabion mats or long, flat Gabion baskets and arranged to contour the marsh edge, spanning from fringing to nearshore habitat. As oyster larvae present in the water column attach to the provided cultch structure and grow, the reef will become a living shoreline. Project Description CRCL proposes to the Louisiana Trustee Implementation Group creating a mile-long near-shore oyster reef composed of recycled oyster shell for installation in the Barataria Basin, a watershed that was acutely impacted by the Deepwater Horizon Oil Spill. We assessed habitat suitability to identify a general target area for this reef and a specific potential reef location that would be likely to sustain oyster populations over 10-50 years (considering that proposed sediment diversions of the Mississippi River begin within this timeframe), support the recovery of oyster resources, and have a high impact on ecosystem resiliency. The target location lies adjacent to the Public Seed Grounds in Hackberry Bay, thus as a living shoreline, the project will increase the availability of oyster larvae to a strategic location. As oyster larvae attach to the provided cultch structure and grow, the reef will become a living shoreline that can provide marsh, submerged aquatic vegetation, and nearshore benthic habitat, and that will filter nitrogenous waste from water, all helping to restore ecological function to shellfish, fish, bird, and other marine communities. Restored ecological function will further benefit the local economy by supporting recreational and commercial fishing industries. The reef will also attenuate wave energy, thus slowing the erosion of the shoreline behind it. As a living shoreline, the reef will also be able to adapt to environmental changes, such as growing vertically to keep pace with sea level rise. Objectives 1. Restore a smaller oyster reef that spans an elevational gradient 2. Enhance oyster abundance and spawning stock adjacent to Public Seed Grounds 3. Reduce shoreline erosion to help maintain hydrological separation from bays to the south affected by oyster predators 4. Restore ecological function to shellfish, fish, bird, and other marine communities by creating/protecting various habitats including marsh, submerged aquatic vegetation, and nearshore benthos 5. Engage the public in oyster restoration activities Measurable Outcomes • Protect 1 mile of shoreline • Establish 1.5-2 acres of oyster reef habitat with cultch • Fortify 12 acres of marsh habitat • Return 2,000 cubic yards of shell to Louisiana's coastal waters • Engage 250 volunteers in coastal resiliency work	Jefferson Parish	$2,630,000
	Canal Backfilling in Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes	Tens of thousands of oil and gas canals were dredged to support oil and gas exploration and production in coastal Louisiana. These canals directly destroyed hundreds of thousands of acres of wetlands, indirectly destroyed or degraded millions of acres of wetlands, and continues to cause ongoing indirect degradation and loss of extremely large areas of wetlands. Indirect degradation and loss is caused by alteration of hydrology, including increased water flow through the canals, saltwater intrusion, impoundment of wetlands via spoil banks, etc. See Turner and McClenachan (2018), and many others (see References in Turner and McClenachan (2018)). Proposed Solution It has been clearly demonstrated that backfilling oil and gas canals in coastal Louisiana is relatively easy and cheap, using small construction equipment (e.g. marsh buggy/backhoe). Turner and McClenachan (2018) estimated it may cost $335 million to backfill all abandoned oil and gas canals in coastal Louisiana. Since this request is limited to Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, this proposal arbitrarily limits the proposed budget of this project to one-half the estimate of Turner and McClenachan (2018), $168 million, plus an additional 50% for land rights, engineering and design, permitting, administration, contingencies, and monitoring ($84 million), or a total budget of $252 million. I propose the project be implemented by the LCPRA, with advice from NPS and Dr. R.E. Turner and colleagues of LSU. The project can be easily scaled down or up. Project Benefit Backfill approximately 34,000 acres of canals within 10 years. Backfill approximately 13,500 miles of canals within 10 years. Convert approximately 240,000 acres of upland spoil bank habitat to emergent wetlands within 15 years. Convert approximately 13500 acres of open water (canal) to emergent wetlands by year 15. Convert approximately 120000 acres of open water (canal) to shallow water habitat by year 15. Increase SAV cover from 10% to 59% in 120000 acres of open water by year 15. Convert 360000 acres of canal and spoil bank to emergent wetlands or shallow water habitat by year 15. Partially restore hydrology to over 21 million ac of emergent wetlands.	Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes	$250,000,000
	non-explosive removal of oil platforms	Rather than blowing up platforms, simply remove them non-destructively by cutting. Or leave them in place as fishing reefs to restore lost fishing opportunities. It is very easy to credit, there is already a BOEM-funded study to evaluate impacts of destructive reef removal. The study estimated that high enough numbers of many reef fish are on reefs so that simply not killing them by explosive removal could make up a substantial creditable biomass.		
	Trinity Island back-barrier marsh, beach, and dune restoration	Restoration Approach Create, restore, and enhance barrier and coastal islands and headlands. Restore and enhance dunes and beach. Project Location Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes Problem All the Terrebonne Basin barrier islands are in an advanced stage of degradation. They serve important functions by protecting landward wetlands and estuaries from higher Gulf energy. They are critical components of any effort to restore the Terrebonne Coastal Basin. A number of barrier island restoration efforts are ongoing. CWPPRA has restored Trinity Island in the past, but this was a limited effort, and the island has lost area and volume since then, California Canal was not filled, and no back-barrier marsh was restored. Proposed Solution One approach that has been used on Whiskey Island, but not on Trinity, is to provide a large back-barrier marsh for the beach, dune, and supratidal habitat to roll over onto as the island retreats landward. This project proposes to create a broad expanse of back-barrier marsh on the landward side of Trinity Island, fill California Canal, and reinforce the beach, dune, and supratidal habitat with additional sand. Finally, the project will install sand fences and vegetative transplants. Project Benefit This project would add over 700 acres of back-barrier marsh and up to one hundred acres of beach, dune, and supratidal habitat. The project would prolong the life of the island.	Terrebonne Parish	
	Integrated restoration and recovery of oyster resources in Calcasieu Lake (LA)	For a suite of reasons, oysters (as a habitat and a fishery) have heavily declined in Calcasieu Lake (southwest Louisiana) over the past decade. Since 1991 stock estimates have peaked at nearly 1,300,000 sacks of seed (less than 3") and sack (greater than 3") oysters each, but from 2012 to the present estimates have averaged closer to 100,000 sacks. This loss represents both the significant reduction of oysters as an important commercial fishery in southwest Louisiana and a loss of the aerial coverage of oysters as an essential estuarine habitat. Both the value of oyster resources as a habitat and fishery and linked and must be considered together when planning for and executing their restoration and recovery (this is true everywhere in the Gulf). As a habitat, healthy, mature oyster reefs protect adjacent shorelines from erosion by abating/deflecting wave energy and acting to accumulate sediment between the shoreline and reef; serve as a complex, structural habitat for many species if shrimp, crabs and fish that rely of reefs as a source for refuge and/or forage for some of all of their life history; and improve or maintain estuarine water quality as oysters filter water in order to feed. As a fishery oyster harvest are a traditional and needed source of income to the communities around Lake Calcasieu; part of the social fabric of these communities; and could also become the source of cultch materials (shell) needed for the long-term maintenance of the fishery. In Calcasieu Lake one of the most limiting factors to the restoration and recovery of oyster resources is available substrate upon which oysters can settle, grow and reproduce. (It should be noted that "restoration" here has two meanings - 1) restoring a viable, self-sustaining habitat and 2) putting cultch material on existing reefs, or making a new cultch plant, that will be harvested.) Currently the state of Louisiana plant cultch material (normally lime rock) in areas that are conducive to oyster growth. Often when these areas are harvest the cultch is lost or because it is close to the grade of the sediment, is buried. Also, reefs and cultch material that have little to no vertical relief are more subject to a higher salinity regime and lower dissolved oxygen - both with bode poorly for long term survival. The project description then is this - 2 to 3 miles of intertidal 6'x6'x1' gabions baskets with rock will be place along the shoreline in West Cove in Calcasieu Lake. The Nature Conservancy already has 1 mile of reef structure using this design in place and has another 2 miles already permitted. Plus, the permit can be amended to include additional coverage. The TNC project was installed in the summer of 2017 and monitoring of the site indicates that oysters are growing, and that shoreline loss is being abated. In addition, a 50-acre cultch plant would be placed in a nearby, subtidal location. The height of this plant would be 12" on average - that will allow for oysters to establish and grow in a salinity and oxygen environment that is more favorable than a cultch plant of lesser height. After this reef has an established, self-sustaining population of oysters it will be made available to harvest by tonging (while not included in the budget of this project ancillary work should be done to retain much of the shell harvested from this reef so that it can be put back on this reef for the long-term maintenance of the site and to reduce or eliminate the need and cost of bringing in lime rock from off-site). The final piece of this project is the siting of an "aquaculture park" that would allow for the off-bottom, cage culture of oysters for commercial sale. This project is designed to recover oyster resources as both a fishery and a habitat. Establishment of aquaculture gives harvest more options for production and increasing the habitat will increase local larval supply and shell availability which is good for habitat and fishery needs.	Cameron Parish	$5,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
Marko Kljaic	Spill oil picking up System	This project is of enhancement type. Comparing to the Golf accident in the 2010 ant the damage and costs which followed it, there is a huge need to have a system which enables to protect both the sea and shore if an accident occurs. Introducing this system is not even comparable with costs we had at the Gulf occasion, it costs much less. The project is intended to prevent large spread of spill oil in case of an offshore accident. In the project, the equipment has been designed that all together make a protecting system, actually, it limits the spill oil to spread over large surface all around an accident place. We have started from point of view that offshore accidents are always possible to occur. More or less we are witnesses after an accident occurs that impacts to environments are inevitable and restoration projects cost very much and take long time. Here we have designed and composed a system that do limit on oil spread, then make it possible to pick up all oil, up to the last drop in the literal sense of the word. This works even at a rough sea, gales and so. How to achieve the goals and perform the actions from the statement above? That is the matter what this Project deals with. The word Project denotes both the System and its application. How to manage with picking up of the spread oil in all sea conditions? The principle used in the System is not to defeat a rough sea, but opposite to take advantage of the sea forces. The meaning is to work together with the sea. To stress importance and efficiency of the Project, freely said, it is a long-term seen strategy. By using the high professional approach to the problem and composition of, already on market existing, and new designed equipment the Project finds how to cope with permanent existing problem which threats to destroy the environment. It is harm that this system has not been applied at Mexico Gulf accident. There would not be so much impact as it was. If the rig were surrounded from beginning of th e accident by sufficient long booms designed for this system, there would not be oil spread at all. The description of the system is available on demand. All described parts of equipment are presented on simplified drawings available on the link at the end of this chapter. For this moment, here, we line up briefly only the chapters and equipment list. More information we will present after you, or some other institution shows an interest for it. System description Part one 1 Floating booms (Very special design) 2 Anchor 3 Buoy and inflation device 4 Floating Pump 5 Hoses 6 Wet oil processing plant (separates oil and water) 7 Working Boat 8 Oil Boat, a large vessel. 9 Split Oil Part two 1. Strategy and realization 2. Information about an accident 3. Monitoring and getting started 4. Crew Part three 1. Scope of supply 2. Know-How The system is very interesting for use in many other purposes: cleaning of harbors, wet oil processing ... Due to the System is subject of a patent protection procedure we do not give any more written details in this suggestion. But we are very ready to do in live our fully presentation on request. You are kindly asked to give us an opportunity to do the presentation. We are confident that after such one presentation we'll do a deal. We are looking forward for your response, Sincerely yours Marko Kljaic In the link below you will found more information about the system. Please open the link by Copy and paste! The up to date description differs from that one in the linked document, there have been some improvements. The scope of supply does not include working and oil boat. https://www.dropbox.com/s/4440xnxbaj5nt2j/SOPS%20-%201115%20r1%203.ppt?dl=0 If the figures and text not sufficient visible open it in the PowerPoint.	Any of them	$3,000,000
St. Bernard Parish Government	Point aux Marchettes Living Coastal and Marine Resources Replenishment and Protection (Phase 1)	The Biloxi Marsh Complex is a 210,000-acre network of wetlands located in St. Bernard Parish, Louisiana between Lake Borgne (west) and the Chandeleur Sound (east). The landform extends northward toward Mississippi and functions as a storm surge barrier for both the New Orleans metropolitan area and western coast of Mississippi. The Biloxi Marsh Complex also provides a vast and productive ecosystem for fish and wildlife, including water column invertebrates such as ribbed mussels (*Geukensia demissa*). Although the landform experienced significant damage during Hurricane Katrina (2005) and the BP Oil Spill (2010), the Biloxi Marsh Complex is more geologically stable than other similarly situated deltaic complexes (T. Baker Smith, Inc., 2006). The prior success of the Louisiana Oyster Cultch project (2013, Natural Resource Damage Assessment Early Restoration) in the Biloxi Marsh is evidence that Natural Resource Damage Assessment (NRDA) funding may be successfully invested in impactful projects that mitigate the damage sustained by fish and water column invertebrates during the BP Oil Spill. However, shoreline erosion also poses a serious threat to the integrity of the Biloxi Marsh Complex and the health of area habitat. Shoreline erosion rates are particularly high along the western, Lake Borgne side of the landform near the Biloxi Marsh Wildlife Management Area (WMA) at Point aux Marchettes. Erosion rates at that location have historically ranged from 10 feet/year to 90 feet/year. The referenced stretch of shoreline is critical to the overall health of the Biloxi Marsh Complex because it protects approximately 500 acres of marsh in the WMA and serves as critical habitat for a number of fish and wildlife species. (St. Bernard Parish Government, 2016; 2018) St. Bernard Parish Government (SBPG) is requesting that the NRDA Open Ocean Trustee Implementation Group (OOTIG) consider funding the engineering/design and installation of approximately 20,000 linear feet of livi ng shoreline products along Point aux Marchettes in the Biloxi Marsh Complex. The purpose of the project is to replenish living coastal and marine resources in the area, particularly fish and water column invertebrates, while also protecting critical shoreline habitat along one of the most vulnerable stretches of the landform. The proposed installation would ultimately replenish and protect habitat for ribbed mussels, fish, shrimp, and crabs. The scope of work for the project is consistent with Louisiana's Comprehensive Plan for a Sustainable Coast (2017 State Master Plan) and the SBPG Coastal Strategy Document (SBPG, 2016; 2018). The total budget for Phase 1 of the project is estimated to be $24 million. Since the project would mitigate the damage sustained by fish and water column invertebrates during the BP Oil Spill, SBPG proposes that it be classified as an OOTIG (replenish and protect living and coastal marine resources, fish and water column invertebrate) restoration effort. Preliminary cost estimates for the engineering/design and installation of approximately 20,000 linear feet of living shoreline were performed using previous estimates generated during the Coastal Wetlands Planning, Protection and Restoration Act Project Priority List 27 process (2017), in which the subject project was a nominee and finalist for Phase 1 (engineering/design) funding. It is estimated that Phase 1 of the project would cost approximately $24 million.	St. Bernard Parish	$24,000,000
	Algae Bottle	My project idea is to take algae and make it into plastic that we can use to make bottles, containers, and anything else plastic. That way if we leave it out in the elements it'll dissolve back into algae and won't hurt the ecosystem.		$10,000
	Institution of a Laboratory Information Management System	This project, instituting a biorepository Laboratory Information Management System (LIMS), addresses restoration Monitoring and Adaptive Management needs by providing infrastructure for efficiently cataloging project samples. This technologic tool provides support to restoration projects, assuring quantitative and qualitative sample inventory details necessary for compliance with laboratory Quality Control and Assurance needs. A biorepository LIMS is an enterprise solution that can provide real-time inventory data to maximize agency efficiency of sample management, facilitating intra- and interagency collaboration and determining geographic gap analysis across multiple taxa (marine mammals, sea turtles, fish, corals, etc.). Simply, LIMS is a database specifically designed to manage samples in a field and laboratory setting, assigning barcoded labels that facilitate automation, tracking, database updates, queries, and reducing labeling errors, improving accuracy and longevity of samples for analyses and use in reference collections. While the launch of a LIMS would begin in the southeast region, it is configurable and web-based with the flexibility to be expanded to other regions and customized to program requirements and needs. There is a great likelihood of success in the implementation of a LIMS product; for example its current use in NOAA line offices including PIFSC and NIST Marine Environmental Specimen Bank as well as other federal agencies (e.g., USDOJ-DEA, CDC, US Military HIV research program) to successfully manage sample inventory and data analysis. As an agency enterprise solution, LIMS would replace a diverse mix of inefficient in-house desktop or antiquated solutions of databases, spreadsheets or logbooks, which compromise service continuity and viability of institutional reference collections. A deficiency was made apparent during the Deepwater Horizon injury investigation as a lesson learned in the management of greater than 40,000 samples tracked including associated, chain of custody, and results. Deficiencies including but not limited to restricted system capacity limits and problematic sample queries encumbered a system not designed to manage the requirements associated with physical and chronological laboratory sample tracking to assure sample integrity and best practices. The institution of LIMS in support of restoration projects that have a sample management need will greatly that enhance the success of the projects.		$400,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Quantifying water availability and quality from submarine discharge points into Gulf estuaries	As resource managers continue to understand the effects of water availability and quality from freshwater systems that drain to Gulf estuaries and bays, one source that is typically unaccounted for comes from submarine outcrops from near-shore aquifers. The USGS has recently updated the Coastal Lowlands Aquifer System (CLAS) groundwater model which can be used to estimate groundwater flow and quantify estimates of water quality/nutrient loads from submarine discharges. Specifically, this project will utilize the updated CLAS model to address groundwater and groundwater/surface-water issues along the Gulf coast to: 1. develop an approximate water budget of groundwater flow to/from the coast; 2. evaluate subsidence related to groundwater withdrawals; 3. evaluate changes in groundwater withdrawals and effects on water budget and water levels which can be used to evaluate scenarios related to increases in GW withdrawals for public-supply, industrial, and irrigation water use; 4. evaluate potential saltwater intrusion; and 5. use groundwater flow quantities and water chemistry data to estimate nutrient loads into Gulf estuaries from submarine waters sources (which can then provide a better understanding of Harmful Algal Boom hotspots across the Gulf). This project could leverage an existing project by the University of Southern Mississippi that is already underway funded by a grant from the Mississippi Water Resources Institute that focuses on identification of groundwater seeps within the Mississippi Sound. Also, this project is indirectly related to priorities of the Water Resources Priority Issues Team of the Gulf of Mexico Alliance to better understand occurrence and distribution of HAB outbreaks in nearshore areas around the Gulf.	Nearly all coastal counties and parishes	$3,000,000
	Chandeleur Islands Holistic Ecosystem Restoration	The Chandeleur Islands (“Chandeleurs”) form an iconic island chain in the northern Gulf of Mexico included in the Breton National Wildlife Refuge, the second oldest refuge in the system. The Chandeleurs are essential for protecting coastal communities; providing habitat for wildlife, including threatened and endangered species and migratory birds (protected species); and for promoting both recreational and commercial fisheries. We propose using natural coastal sediment dispersal processes as tools to restore the Chandeleurs. Wave driven currents run parallel to the Chandeleurs eroding sand from islands and transporting it to “sand sinks” north and south of the islands. Hewes Point, a submerged sand spit, is one of these “sand sinks” that consists of sand eroded from the island chain. The sand at Hewes Point can be mechanically returned to the central part of the system, extending the island lifespan by centuries. We propose: • Mining sand from Hewes Point and strategically placing sand reserves behind the center of the island chain (see figure 1B); • Mimicking a natural process by allowing shoreline erosion to slowly feed sand from the reserves to the beaches, replenishing sand lost on the beach; • Protecting sand reserves from storms by placing them mostly below the mean water line where the destructive forces of storms are minimal; • Using tidal passes and low areas in the dune as pathways to ensure that sand is retained within the system, maximizing the longevity of this restoration; • Using sediment to restore New Harbor Island which is an important bird rookery. Replenishing the Chandeleurs’ depleted sand reserves will promote large scale holistic ecosystem restoration by: o Adding longevity (centuries) to the island and seagrass beds and the fishes, sea turtles, and birds that rely upon them; o Preserving and create additional habitat for protected species; o Creating sand reserves behind the islands that will provide a growing platform for ma rsh grasses and black mangroves, which will provide habitat for marsh birds, colonial water birds, shorebirds, and other wetland organisms; and o Creating a self-sustaining system that could carry benefits for coastal communities, fisheries, and protected species over the long term (centuries). Barrier island restoration projects usually require regular maintenance and quickly erode (decadal).	St. Bernard Parish	$147,000,000
	Development of a Decision Support System to address management of nutrient and sediment loads entering bays and estuaries from Gulf watersheds.	This project will build an online Decision Support System (DSS) that will allow managers to run scenarios by altering identified sources of nutrients or sediment within Gulf watersheds to see the downstream effects of those scenarios on nutrient and sediment loads entering bays and estuaries across the Gulf. The DSS will be based on development of Total Nitrogen, Total Phosphorus, and Suspended Sediment Spatially Referenced Regressions on Watershed Attributes (SPARROW) models for the entire Gulf. In addition, display of model results in the DSS can help managers target watershed areas with high nutrient loads to better locate Best Management Practice implementation. Nutrient load estimates from the models entering bays and estuaries can also be used as nutrient inputs to available hydrodynamic models to identify potential hot spots across the Gulf for Harmful Algal Bloom outbreaks. Sediment models can help locate hot spot areas for high sediment loads within Gulf watersheds, which could be important to manage wetland restoration.	All coastal counties	$4,000,000
	Chandeleur Islands Holistic Ecosystem Restoration	The Chandeleur Islands (“Chandeleurs”) form an iconic island chain in the northern Gulf of Mexico included in the Breton National Wildlife Refuge, the second oldest refuge in the system. The Chandeleurs are essential for protecting coastal communities; providing habitat for wildlife, including threatened and endangered species and migratory birds (protected species); and for promoting both recreational and commercial fisheries. We propose using natural coastal sediment dispersal processes as tools to restore the Chandeleurs. Wave driven currents run parallel to the Chandeleurs eroding sand from islands and transporting it to “sand sinks” north and south of the islands. Hewes Point, a submerged sand spit, is one of these “sand sinks” that consists of sand eroded from the island chain. The sand at Hewes Point can be mechanically returned to the central part of the system, extending the island lifespan by centuries. We propose: • Mining sand from Hewes Point and strategically placing sand reserves behind the center of the island chain (see figure 1B); • Mimicking a natural process by allowing shoreline erosion to slowly feed sand from the reserves to the beaches, replenishing sand lost on the beach; • Protecting sand reserves from storms by placing them mostly below the mean water line where the destructive forces of storms are minimal; • Using tidal passes and low areas in the dune as pathways to ensure that sand is retained within the system, maximizing the longevity of this restoration; and • Using sediment to restore New Harbor Island which is an important bird rookery. Replenishing the Chandeleurs’ depleted sand reserves will promote large scale holistic ecosystem restoration by: o Adding longevity (centuries) to the island and seagrass beds and the fishes, sea turtles, and birds that rely upon them; o Preserving and create additional habitat for protected species; o Creating sand reserves behind the islands that will provide a growing platform for marsh grasses and black mangroves, which will provide habitat for marsh birds, colonial water birds, shorebirds, and other wetland organisms; and o Creating a self-sustaining system that could carry benefits for coastal communities, fisheries, and protected species over the long term (centuries). Barrier island restoration projects usually require regular maintenance and quickly erode (decadal).	St. Bernard Parish	$147,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Backfilling to Restore Louisiana's Canals	Canals have caused most of Louisiana's landloss. Backfilling canals both prevents and restores land loss, and there are 27,483 potential canals on land available for backfilling if the money and political will prevails. Many canals are supposed to be backfilled upon abandonment but are not. The absence of a State or Federal backfilling program is a huge missed opportunity to conduct cost-effective restoration that could be done at a relatively low cost (Baustian et al. 2009). The vast majority of coastal wetland is privately owned, with the remainder in various public agencies including School Boards, non-Governmental Agencies, State and Federal Lands. It may take some organized and low-key persuasion, but canals could be backfilled within a program that was positively promulgated by State government. A State bundling of many backfilled sites within one effort would probably have economies of scale that doing one at a time do not; backfilling success is partially dependent on operator skill (Neill and Turner 1987), and a systematic monitoring and hypothesis testing program would advance restoration knowledge and future attempts. The price of backfilling (without sediment) was $9,266 per ha ($22,897 per acre) in 2005, and $12,224 per ha ($30,206 per acre) in 2018 when adjusted for inflation. The rough approximation of filling in all abandoned canals is, therefore, about $335 million dollars, or one fifth of the cost of one river diversion. The total crude oil production since 1900 in the southern region was $613 billion at $60 per barrel, or 0.05% of the cost to restore all of the now abandoned or plugged canals on land in the same region. The State restoration plan is a minimum of $50 billion dollars over the next 50 years. Can 0.67% of that money be spent to reverse/restore the cause of the land lost?		$3,000,000
	Establishment of a Marine Monitoring, Energy and Environmental Research, Science Education, and Training (MMEERSET) Station in the Gulf of Mexico	The Gulf of Mexico Outer Continental Shelf (OCS) region hosts the highest concentration of energy exploration, development, and production facilities in U.S. OCS waters with >2,400 platforms. As such, monitoring, research, education, training, and response capabilities are essential – particularly in the Northern Gulf of Mexico, the primary focus of the NRDA Deepwater Horizon Restoration efforts. These needs have been clearly identified during the spill response by former NOAA Administrator Jane Lubchenco (Voosen, 2010), and afterwards in the NRDA PDARP and EIS, as well as other national and regional plans and scientific articles (National Research Council, 2011; Liu, Weisberg, Hu, and Zheng, 2011; Lubchenco et al., 2012; Murawski and Hogarth, 2013; National Research Council, 2014a; National Research Council, 2014b; Gulf of Mexico Coastal Ocean Observing System, 2015; Love et al., 2015; National Research Council, 2015; Watson et al., 2016; and the Ocean Research Advisory Panel, 2017). After the spill response, the National Research Council published a Special Issue to summarize the science used in the response to DWH and the gaps that remain, with a primary finding that insufficient baseline information on the functioning of the Gulf as a Large Marine Ecosystem severely limited spill response efforts (Lubchenco et al., 2012). As the NRDA Trustees documented in the Final PDARP and PEIS for the DWH spill, scientific information was essential for injury assessment - with hundreds of scientific studies implemented 2010 – 2015. However, in the absence of actual scientific information, scientific inferences were sometimes necessary to estimate the impacts of the DWH spill and prepare the restoration plan. To help provide the baseline information necessary for future effective preparedness and response, and to reduce the need for inferences to restore damaged resources in the future, the Marine Monitoring, Energy and Environmental Research, Science Education, and Training (MMEERSET) Station is proposed. The proposed project consists of leasing and efficiently converting one or more existing oil and gas platforms already slated for decommissioning in the area most affected by the DWH spill into a monitoring and research station. The project is an effective, efficient approach to concurrently address preparedness, response, and restoration that will capitalize on an existing structure in a priority area of the OCS with habitat for many of the PDARP's 13 restoration types (e.g., sturgeon, fish and water column invertebrates, mesophotic and deep benthic communities, birds, sea turtles, and marine mammals). Education and Training: The station can provide opportunities for professional educators and educational institutions to have real-time underwater video and other information on the offshore environment. Plans include an underwater lab/classroom. Proposed activities include: 1. Converting an existing oil and gas platform in the Gulf of Mexico slated for decommissioning into a marine research and monitoring station; and 2. Operating that platform for its new purposes. Data applications: The potential applications of the data collected from a MMEERSET station are numerous and include, for example: baseline conditions, spill trajectory modeling, restoration, fish habitat research and monitoring, marine mammal monitoring, seabird monitoring, physical oceanography/structural design/energy, renewable energy testing, hurricane prediction modeling, mariculture research, underwater operations, climate change, ocean observing, air quality, education and ecotourism. Restoration outcome: The proposed project will provide critical information on locations and restoration types identified in DWH PDARP and PEIS. The information can be used for assessment of restoration activities and adaptive management. It will also provide scientific information necessary to help respond to future events and meet future restoration needs.		$4,000,000
Dr. Louis J. Thibodeaux and Dr. David W. Constant	Artificial enhanced transport of atmospheric oxygen into Gulf water to eliminate hypoxia	Artificial enhanced transport of atmospheric oxygen into Gulf water to eliminate hypoxia RxHYPOXIA – the conceptual approach: Dr. Louis J. Thibodeaux, Emeritus Professor, Department of Environmental Science [Emeritus Chemical Engineering], LSU Baton Rouge. thibod@lsu.edu Dr. David W. Constant, Chaired Professor and Chair of Department Biological and Agricultural Engineering, LSU Baton Rouge. DConstant@agcenter.lsu.edu A vast hypoxic zone develops every summer and lies along the Louisiana coastline. Termed 'the Dead Zone,' it is considered the second largest in the world. Measured oxygen (O2) profiles obtained yearly demonstrate the problem in the Gulf of Mexico. Water density stratification in the shallow shelf water restricts efficient O2 downward movement from the atmosphere to the seabed. Our theoretical model for O2 movement indicates that specific subsurface layers are resisting its transport rate. Coupled with the field measurements, the model is used to identify the layer depth, thickness and its O2 resistance contribution. The model-generated transport parameters and flux data concerning O2 behavior provide valuable information and insight about its mobility. The patterns and characteristics reflected in the model-derived data and then used to guide a proposed solution and a design procedure. Mechanical water mixing is an effective O2 re-aeration technology is common use. We showing its effectiveness in laboratory experiments breaking density stratification at depth in the water column. This report is a brief overview of the research progress on the RxHYPOXIA project, both laboratory experiments and theoretical model studies. Our laboratory is located in Biological and Agricultural Engineering, 101 Aquaculture Research Building, E. B. Doran Hall, Louisiana State University Campus. RxHYPOXIA is an alternative chemical approach, aimed at enhancing oxygen transport a 20-meter (~35 feet/~10 meters) travel distance. The ongoing chemical approach is aimed at diverting nitrogen-containing waters from entering the Mississippi River along its entire length ~1,000 miles (1,600,000 meters), travel distance. The enhanced aeration devices required for the RxHYPOXIA solution will obtain power from sea surface wind machines, solar energy, wave-energy generators, etc. Abandoned, existing in-situ, and re-located oil and gas offshore equipment may be used as well. These and alterative devices and procedures enhancing the downward transport of atmospheric, molecular oxygen (O2) to relieve the ongoing demand on the Gulf seabed (aka hypoxia) must be developed. It has been noted that the current efforts to reduce nitrates in the river from agriculture fertilizer runoff are voluntary and not being done on a large scale, there are many social and political hurdles. The current approach may eventually prove effective but a locally developed, funded and controlled one, in the short-term is needed now to maintain marine life so vital to the Louisiana fishing industry, tourism, etc. INTRODUCTION. The atmosphere is the primary source of molecular oxygen, O2, and its consumption in the seabed each fall season that impacts the extent of hypoxia in the benthic boundary layer. Almost all measured vertical oxygen profiles (2015 data) show high O2 concentration levels at the air/water interface and in mixed layer which range from ~5.0 to 6.3 mg/L. The low levels above the bed sediment are 0.0 to 2.0 mg/L. A very few surface values upward to ~8 to 9 mg/L suggest algal growth respiration may be contributing O2 to the water. See Figure 1. Such vertical measured steady-state O2 profiles are present for weeks to a month along the shallow depth [5-20 m.], ~240 km length, and ~30 km wide "footprint" along the northern Gulf of Mexico shelf area. It extends westward from the mouth or the Mississippi River to the Louisiana-Texas state line and beyond. See Figure 3. HYPOTHESIS. The hypothesis: The targeted mechanical mixing of the thin stratifie		
	Post Hurricane Harvey coastal assessment, Chenier Plain Louisiana	In July 2017 the USGS St. Petersburg Coastal and Marine Science Center (SPCMSC), in collaboration with the Louisiana Coastal Protection and Restoration Authority (CPRA), conducted a high-resolution bathymetric survey from Marsh Island Louisiana to Sabine Texas. Using shallow water vessels, the nearshore was surveyed from the shoreline out to 2 km. The study is part of the CPRA Barrier Island Comprehensive Monitoring (BICM) project, and will include a bathymetric and shoreline change assessment, as the Chenier Plain shoreline is one of the highest eroding shorelines in the country. On month later in August 2017 hurricane Harvey made landfall to the west of the study area. The storm then headed offshore and made a second landfall within the study area, between Lake Calcasieu and Lake Sabine. This provides a rare opportunity to capture the impact of a landfalling tropical storm on a highly sensitive coastal environment. The project proposes re-occupying the survey conducted in July 2017, between Lakes Calcasieu and Sabine to measure the bathymetric and shoreline change that occurred during the storm. This information is also necessary for any management or restorative action. The SPCMSC will provide the vessels, equipment, and technicians to collect and process the data, and publish the results.	Cameron Parish	$170,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Reduce Harm to Dolphins by Determining Scope of Hook & Line Fishing Gear Interactions & Fishermen Attitudes	Fishing interactions between hook-and-line (rod and reel) gear and bottlenose dolphins occur throughout the Gulf and are increasing (Powell & Wells 2011; Shippee et al. 2011). Rod and reel gear are used by either for-hire fishing vessels (e.g., charter and head boats) or anglers. Dolphin interactions with the gear largely result from dolphins taking the bait or catch directly off a hook (e.g., depredation) or eating discarded fish (e.g., scavenging) (Powell & Wells 2011; Read 2008; Zollett & Read 2006). These behaviors are likely propagated by illegal feeding of wild dolphins which teaches the animals to associate anglers with food (Christiansen et al. 2016). Interactions may result in lost or damaged gear and fishermen frustration from dolphin depredation and scavenging behaviors. For dolphins, it may cause lethal injuries from fishing gear entanglements or ingestions, and related mortalities (e.g., fisher retaliation by shooting). Based on Gulf stranding data records from 2002-2015, 97 bottlenose dolphins stranded with hook-and-line gear attached (NOAA National Marine Mammal Health and Stranding Response Database unpublished data; accessed 2 May 2016). Stranding numbers may be up to three times higher because only a portion of animals that strand are detected and recovered (Peltier et al. 2012; Wells et al. 2015; Williams et al. 2011). There have also been federally investigated and prosecuted cases of fishermen retaliating against dolphins out of frustration for the dolphin's depredation behaviors (Vail 2016; Department of Justice 2007). Therefore, this project will reduce lethal impacts to dolphins from hook-and-line fishing related interactions known to occur within Gulf waters by: (1) Conducting systematic surveys to determine the magnitude and extent of dolphin and hook-and-line gear interactions and characterize the nature of these interactions (e.g., mapping fishery effort distribution, identifying factors leading to dolphin-gear interactions, detec ting hot-spot sites, etc.). (2) Conducting social science studies (e.g., surveys, focus groups, interviews) to characterize fishermen's attitudes and perceptions towards dolphins and fishing gear interactions, their likelihood to take various actions (both preventative and retaliatory) and their responses to various outreach messages and approaches. This project will survey anglers and for-hire boat captains/owners and their patrons. It will include fishermen fishing from both vessels and piers, fishing in a variety of habitats (i.e., coastal and estuarine), and targeting various fish species using different gear configurations in all coastal Gulf state waters. Project results will help identify what gear factors may increase the likelihood of interactions, the frequency of dolphin and gear interactions and approximate risk of lethal injury from interactions, and whether there are hot-spot areas where interactions are more likely to occur. We will then work with stakeholders to identify, develop, and evaluate conservation measures to reduce interactions (e.g., potential gear or fishing practice modifications, safe and effective deterrence techniques, etc). This project will enhance survivorship and resiliency of bottlenose dolphins by reducing lethal impacts resulting from fishing interactions between dolphins and rod and reel fishing gear. Repeating systematic surveys, social science studies and evaluating stranding data may be used for project monitoring.	NA	$1,200,000
	Outreach, Implementation and Assessment: Using Descending Devices to Reduce Post-release Mortality of Reef Fishes in the Gulf of Mexico Recreational Fishery	This proposed project will provide descending devices to recreational anglers (private and for-hire) and conduct educational outreach on best practices and the proper use of these devices throughout the Gulf of Mexico. In addition, the Southeast Region Headboat Survey (SRHS) will implement a monitoring and fish tag/recapture program on headboats participating in the survey in order to collect information on the utility, effectiveness and impacts of descender devices on post-release mortality in the Gulf of Mexico headboat fishery. Recreationally important species with high release mortality, including; red snapper, gag grouper, vermilion snapper, red grouper; as well as strictly regulated species such as goliath grouper, speckled hind, Warsaw grouper and Nassau grouper, will be the focus of this program. Additionally, the effectiveness of descending devices on reducing dolphin depredation will be evaluated. In order to raise public awareness on the problem of fish barotrauma and the benefits of using descending devices, outreach will be conducted at boat shows, fishing tournaments, fishing clubs, and civic events from FL to TX. Outreach will include distributing educational DVDs “Downscope: Saving Snapper and Grouper from Barotrauma” and descending devices to anglers that may otherwise not obtain or purchase these items. The implementation and monitoring component of this project incorporates a design that includes the SRHS electronic logbook (eLog) system, SRHS dockside sampling and at-sea observers. In addition to utilizing existing SRHS infrastructure and capabilities, the addition of at-sea observers will provide • total number of fish discarded • lengths of fish from a subsample of discards • number of fish descended on devices • the ability to tag a subsample of fish descended and fish not descended, for subsequent analysis of recapture rates. Partners in this project include Sea Grant, Gulf States Marine Fisheries Commission, recreational fishing asso ciations, and state agencies. This collaboration ensures regional coverage and makes this project well-suited for promoting best practices and the proper use of descending devices, along with monitoring and evaluating the impacts on reducing post-release mortality and improving post-release mortality estimates.		$4,550,000
	Connectivity Patterns of Blue Crabs in the Gulf of Mexico: Defining Stock Boundaries of a Migratory Species to Inform Restoration, Assessment, and Management	Blue crabs support a valuable fishery in the Gulf of Mexico (GOM), worth over $73 million in 2015. Despite active management, many states have seen declines in harvest in recent years, which could be indicative of declines in spawning stock abundance, larval abundance, and/or post larval recruitment. Blue crabs have a migratory life cycle, inhabiting different estuarine and offshore habitats at different life history stages. These migrations result in both spawning females and larvae occurring offshore in large numbers, dispersing long distances, and crossing management boundaries. Management, assessment, and restoration strategies are most effective at a geographic scale that matches the geographic scale and boundaries of the stock. The modern stock concept describes units of a population that can be considered homogeneous for management purposes and can inform the scale of stock assessments and management/restoration actions. In the GOM, stock identification for blue crabs has only recently been undertaken. Difficulties in assessing stock structure and boundaries have arisen due to a lack of information on connectivity patterns and unclear and often conflicting population genetic information. Understanding how physical and biological factors influence connectivity is necessary for marine fisheries management and restoration, especially in the face of environmental stressors such as climate change and oil spills. This is especially critical for species with migratory life cycles, such as blue crabs, whose offshore distribution of spawning females and larvae results in a high probability of encountering oil from a spill such as the Deepwater Horizon oil spill. For the most recent Gulf-wide stock assessment, the Gulf States Marine Fisheries Commission was forced to draw stock boundaries based on one state’s tagging study, unclear genetic data, the stock structure of other species, and generic ocean current patterns. This exercise revealed that a basin-wide understanding of population structure and stock boundaries is a priority research need of both state and regional management agencies. The goal of this research program is to fill this knowledge gap. Developing a more complete understanding of connectivity patterns and stock boundaries will allow managers to develop adaptive management, assessment, and restoration plans for this species. The overarching objective of this study is to transform our understanding of connectivity patterns and stock structure of blue crabs in the GOM. We will work closely with managers to accomplish the following objectives: 1. To map the distribution of spawning females and larvae in offshore waters, assess reproductive output and future reproductive potential, and identify important spawning grounds. Information from existing Gulf-wide trawl and plankton surveys will be enhanced by collection of detailed reproductive data and targeted surveys in likely spawning areas. 2. To simulate interannual variability in transport of blue crab larvae between spawning grounds and estuary mouths and estimate Gulf-wide connectivity patterns by applying a Gulf-wide larval transport model. The three-dimensional larval transport model will integrate results of trawl and plankton studies with results from previous mark-recapture studies to estimate transport and connectivity in ten years of model simulations. 3. To synthesize observations, model predictions, and recent genetic information to provide integrated and actionable results for state and federal fisheries managers in the Gulf region. By including fisheries managers in this research, responding to their information needs, and directly disseminating integrated results to them, this research will support improved future stock assessments, management decisions, and restoration plans while promoting a better understanding of the stock structure of this ecologically and economically important species.		$1,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Long term acoustic monitoring of colonial water birds and shorebirds	Colonial water birds, including several listed species and species of local and regional concern, nest in large colonies along the shorelines and islands of the entire Gulf coast. These colonies are typically established within proximity to good foraging sites in suitable nesting substrate (trees, shrubs, ground) that are not excessively disturbed and provide protection from, or absence of, predators. Threats to these colonies include human disturbance, overcrowding, nesting habitat degradation, and depredation. Changes in water levels and water chemistry due to climate change presents and additional consideration when managing and protecting colonies. Colony collapse can occur if foraging sites collapse which is often tied directly to water levels at critical rearing stages. Water levels can also affect colony access by humans and by predators. Typical surveys are expensive due to the human resource needs and aerial survey needs. While these surveys are necessary, they provide snapshots of colony activity and do not provide accurate timing of events over long (decades) monitoring periods. Particularly in light of climate change, slight changes in the timing of nesting and fledgling could have profound population effects over the long term. Acoustic monitoring of colonies provides a cost-effective, continuous (24 h) record of all colony activities. Acoustic cues can pinpoint episodic events such as colony predators (not all of which occur during observable, daylight hours) and natural or human disturbance; or it can provide timing information on arrival, colony establishment, chick feeding, and abandonment. Additionally, there have been several studies that have demonstrated that colony abundance can be correlated to acoustic activity. We recommend establishing a long term acoustic monitoring program in each of the Gulf states that will supplement ongoing surveys to better establish strong correlations between traditional survey methods and acoustic methods. The program can be modified as necessary to include additional colonies, areas that are under-surveyed, or areas that are part of a restoration program. A minimum of four colonies (two tree/shrub nesting and two ground nesting) in each Gulf state will be instrumented with 1 to 3 (depending on colony size) autonomous acoustic recorders prior to nesting season. Recording will be continuous until collection after nesting season. At least four sites will be equipped with iPAM™ software such that near real-time data will be sent to a web-based user portal where events can be monitored. Acoustic data will be processed for ambient sound levels, spectral content, episodic acoustic events over the average ambient levels and vocal behavior. Environmental data, survey data, and acoustic data will be analyzed for correlations specific to nesting success or failure at each site and as a whole along the Gulf Coast. We propose an initial 5-year, 5-state, 20-site program. This long-term approach provides for continuous monitoring and increases sampling effort during nesting seasons throughout the Gulf Coast.	Escambia, Hillsborough, Charlotte, Lee, Collier, Monroe, Mobile, Baldwin, Hancock, Harrison, Jackson, Cameron, Terrebonne, Lafourche, Plaquemines, Kenedy, San Patricio, Aransas, Calhoune, Refugio, Chambers, Jefferson	$580,000
	Northern Gulf of Mexico Super Project	Goal of the project is to enhance habitat and augment wild stocks through an aquculture base project. To bring together all of the current educational resources of the Gulf Coast to create an educational mecca for ocean studies programs. To create a large consortium of stake holders in the Gulf to share resources that can be received through the restoration efforts and BP funding to super utilize and maximize the restorative process. Currently, there are near 700 projects requesting funding from the BP settlement grants that have been allocated. Many of these projects are redundant, not in the materials or siting, but in the logistical requirements needed to complete them. I believe that in combining asset requirements, and through proper scheduling and project resources, that it will be possible to greatly reduce cost, while increasing efficiency and longevity of the selected projects. Working in unison will also encourage communication and cooperation between all the separate entities involved. Example; after reading through the project lists, there are no less than 100 separate projects that either stipulate the acquisition of a vessel through purchase or leasing a vessel for a specified period of time. Some of these are purely scientific research endeavors, others are involved in delivery or deployment of reef materials. Vessels are an expensive proposition for any project, in most cases they are the most important and expensive line item, in any project. To let them sit idle is to still incur the cost, while representing a loss of valuable production time. Leasing a vessel gains that vessel for a preset period, but for long term ongoing projects, represents cost with no equity. To utilize one vessel capable of the versatility of handling a multitude of projects and tasks, would increase efficiency on many levels. Having the ability to load modular equipment on to a deck, complete the project, return, and in a matter of hours be refitted for a completely different project, and the duties that are included, would mean that the funding dollars that would have only served one particular endeavor, can now accomplish twenty. Resources to manage the vessel are kept to a minimum, crew familiarity with the vessel is at a maximum, and in turn operating and maintenance cost are reduced as well, substantially. The funding not duplicated on repetitive vessels would mean the amount of separate projects could be quadrupled with the same amount of funding. This would ensure that the restorative effort gains the most from each dollar put forth and would also give a larger amount of projects the longevity they need to be accomplished. Using the network of sharing the vessels would create, different projects and groups would also be exposed to each other and be able to share both data, and expertise gathered through the entire restoration projects course. Extending the beneficial cycle of the restorative effort indefinitely to aide in the education of the coming generation most affected by this spill.	Galveston,Cameron,Baldwin,St. Mary,Franklin,Bay,Okaloosa,	$120,000,000
	Deployment of VisNIR DRS for Rapid, On-site Quantification of Total Petroleum Hydrocarbons	Visible near infrared diffuse reflectance spectroscopy (VisNIR DRS) has been proven effective at on-site quantification of total petroleum hydrocarbons (TPH). The non-destructive, proximal sensing technology uses visible and near infrared light to assess hydrocarbon levels. Soil samples containing hydrocarbon reflect less light (a spectral absorbance) than non-contaminated soils of similar composition. This reduction in reflection can be precisely measured via both wavelength and intensity of returned spectral scans and correlated with established levels of TPH through computer algorithms. The approach provides multiple benefits over traditional sampling/lab work: 1. results are returned to the investigator, on-site instantly, 2. linked with GPS, data from the scans can be used to produce spatial variability maps of contamination or document temporal reductions in contaminant levels in response to remediation techniques deployed, 3. the process is non-destructive allowing for sample preservation for future comparisons, and 4. minimization or elimination of traditional laboratory analyses saves considerable money over long periods of deployment. Through three rounds of evaluation, the technique has been successfully demonstrated to the US Coast Guard and members of the BP HITT team. Furthermore, the technique was featured on the July/August 2010 cover of the Journal of Environmental Quality, a high level, peer-reviewed journal of environmental science. What remains to be done is full scale deployment of this technique across contaminated areas of the Gulf Coast for rapid TPH quantification. The objectives of this proposal are to define the following: 1. scope of work germane to implementation of VisNIR DRS for TPH quantification on the Gulf Coast, 2. definition of the roles of various partners in the implementation, 3. establish deliverables of the project, 4. establishment of a tentative timeline for implementation and, 5. costs/budgets associated with deployment of this technology.	Lafourche, Walton, Pointe Coupee, Sabine, Cameron	$405,154

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Migratory Species Conservation in the Gulf of Mexico: Assessment for Restoration and Online Tools	This proposal directly supports restoration planning by distributing different restoration strategies across multiple restoration areas – such as those for fish, sea turtles and marine mammals. It will use the criteria and goals identified in the Strategic Frameworks for Restoration as guidance for project selection, scale and implementation. We propose to further analyze the migratory movements of species in these groups and the threats for restoring their populations and synthesize this knowledge in a series of apps in the publicly available Blueways Conservation SDSS. This project will advance the activities and investments of the Open Ocean TIG by: • Further defining the most important migratory pathways in the Gulf for species damaged by the Deepwater Horizon Oil Spill • Identifying the most significant threats to those pathways • Designing strategies for addressing those threats which can then be implemented using Open Ocean Natural Resource Damage Funds This project will use existing national and international databases (e.g., presence, presence-absence, movement, nesting), to conduct an expanded migratory pathways assessment and use a spatial optimization model to identify the most important blueways along coastal (including estuarine and nearshore) and offshore ecosystems in the Gulf of Mexico (including the pelagic habitat) that we should prioritize for different restoration strategies		$500,000
	non-destructive removal of oil/gas infrastructure	Rather than exploding obsolete oil and gas infrastructure, with the concomitant death of fish, turtles, etc, these structures can be cut and either left in place or removed. It is more costly than blowing up rigs but it has the direct restoration benefit that the fish that would otherwise have been killed are not killed.		
Dr. Louis J. Thibodeaux and Dr. David W. Constant	Artificial enhanced transport of atmospheric oxygen into Gulf water to eliminate hypoxia RxHypoxia – the conceptual approach	DRAFT PI. Dr. Louis J. Thibodeaux, Emeritus Professor, Department of Environmental Science [Emeritus Chemical Engineering], LSU Baton Rouge. thibod@lsu.edu PI. Dr. David W. Constant, Chaired Professor and Chair of Department Biological and Agricultural Engineering, LSU Baton Rouge. DConstant@agcenter.lsu.edu Students: Schexnayder, Amelia; Nickles, Lauren; Brown, Seth; Theiessen, Maureen; Haque, Samuel; Mixon, Allison; Wells, Jasemaine. Faculty Consultants: Li, Chunyan (DOCS); Rabalais, Nancy (DOCS); Turner, Eugene (DOCS); Malveaux, Charles (BAE); Cramer, Gail (AgCENTER); Muley, Panjali (BAE); Whittemore, Raymond (CEE, UMaine); Financial Support: Biological Agriculture Engineering; Department Chemical Engineering; Environmental Science Department; Office Research Economic Development. ABSTRACT A vast hypoxic zone develops every summer and lies along the Louisiana coastline. Termed 'the Dead Zone,' it is considered the second largest in the world. Measured oxygen (O2) profiles obtained yearly demonstrate the problem in the Gulf of Mexico. Water density stratification in the shallow shelf water restricts efficient O2 downward movement from the atmosphere to the seabed. Our theoretical model for O2 movement indicates that specific subsurface layers are resisting its transport rate. Coupled with the field measurements, the model is used to identify the layer depth, thickness and its O2 resistance contribution. The model-generated transport parameters and flux data concerning O2 behavior provide valuable information and insight about its mobility. The patterns and characteristics reflected in the model-derived data and then used to guide a proposed solution and a design procedure. Mechanical water mixing is an effective O2 re-aeration technology is common use. We showing its effectiveness in laboratory experiments breaking density stratification at depth in the water column. This report is a brief overview of the research progress on the RxHYPOXIA project, both laboratory experiments and theoretical model studies. Our laboratory is located in Biological and Agricultural Engineering (BAE), 101 Aquaculture Research Building, E. B. Doran Hall, Louisiana State University Campus. INTRODUCTION. RxHYPOXIA is an alternative chemical approach, aimed at enhancing oxygen transport a 20-meter (~35 feet/~10 meters) travel distance. The ongoing chemical approach is aimed at diverting nitrogen-containing waters from entering the Mississippi River along its entire length ~1,000 miles (1,600,000 meters), travel distance. The enhanced aeration devices required for the RxHYPOXIA solution will obtain power from sea surface wind machines, solar energy, wave-energy generators, etc. Abandoned, existing in-situ, and re-located oil and gas offshore equipment may be used as well. These and alterative devices and procedures enhancing the downward transport of atmospheric, molecular oxygen (O2) to relieve the ongoing demand on the Gulf seabed (aka hypoxia) must be developed. It has been noted that the current efforts to reduce nitrates in the river from agriculture fertilizer runoff are voluntary and not being done on a large scale, there are many social and political hurdles. The current approach may eventually prove effective but a locally developed, funded and controlled one, in the short-term is needed now to maintain marine life so vital to the Louisiana fishing industry, tourism, etc. The hypothesis: The targeted, downward, mechanical, mixing destruction of selected, thin, stratified, water layers causing high-resistance to O2 downward transport in the marine water column will significantly ventilate the Gulf shelf bottom waters and relieve hypoxia. EARTH'S ATMOSPHERE IS THE SOURCE OF GULF QXYGEN. The atmosphere is the primary source of molecular oxygen, O2. It enters through the a	OFFSHORE LA AND TX	
	A Marsh Bird Monitoring and Assessment Program for Louisiana	Louisiana contains approximately 40% of the coastal salt marshes in the continental United States but accounts for approximately 80% of the nation's coastal wetland loss. Marsh birds are considered important for conservation purposes, may serve as good indicators of marsh health, and provide economic opportunities for bird-watching recreational use, but they represent a group of species that are difficult to observe directly. Oil that occurred on marsh edges and penetrated deeper into interior marsh contaminated habitat used by a variety of marsh birds, including rails, seaside sparrows, waterfowl, wading birds, gulls, pelicans, shorebirds, and black skimmers. More than 8,500 individuals representing nearly 100 bird species associated with oil-affected habitats were collected dead or impaired throughout the five Gulf Coast states during wildlife rescue response and NRDA operations. More than 3,500 additional birds, across numerous species, were also observed with external oiling. Although mortality was not estimated beyond the marsh edge, tens of thousands of birds were at risk of oil exposure within this habitat. The purpose of this project is to (1) create a coast-wide monitoring program for coastal marsh birds in Louisiana that will track broad scale patterns of species occurrence, (2) provide occurrence and abundance data at restoration sites to assist in evaluating restoration efforts in an adaptive management framework, and (3) assess the cumulative effects of all marsh restoration projects to achieve a sustainable environment for marsh birds coast-wide. This data will support project-level evaluations while simultaneously creating a comprehensive system to evaluate cumulative effects coast-wide, as opposed to project-by-project monitoring. The nested design of this effort will result in data that is scalable. This proposed monitoring project would fulfill the TIGs commitment to, as defined in the Trustee Council's Standard Operating Procedures, project-level monitoring for all projects, while also supporting the evaluation of all Bird Restoration Type projects by providing for consistent monitoring protocols that allow one to synthesize data to evaluate Restoration Type success. This project could be funded through phases. In the first phase of the program, sites will be co-located with: (1) existing coastal marsh reference sites in Louisiana (Coast-wide Reference Monitoring System [CRMS], 390 sites) and (2) existing and planned DWH marsh restoration projects (DWH sites in LA-26). During Phases 2 and 3 of the program, additional sites will be established throughout coastal Louisiana as part of a comprehensive coastal monitoring framework that is connected to the broader System-Wide Assessment and Monitoring Program (SWAMP). This monitoring will be conducted at two scales to address different questions. At the landscape scale, automated audio recording units (ARU) will be installed at a large number of sites in coastal marshes to provide the monitoring data necessary to understand how occupancy dynamics are changing for the marsh bird species along the Gulf coast. These data will be used to determine the status and trends of marsh bird species, as well as information about the habitat relationships of these birds and their landscape-scale distribution. This information will be important for cumulative evaluation of marsh restoration projects using marsh birds as a metric of success and for species conservation. At a finer scale, traditional marsh bird monitoring point count protocols involving human observers and call playback techniques will be used to estimate abundance of marsh bird species. These sites will be used to monitor the response of birds to restoration and could be used as part of the monitoring and assessment of a structured decision-making adaptive management approach that will allow managers to repeatedly evaluate which marsh restoration methods have the greatest effect for marsh birds.	Terrebonne Parish	

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Enhancing Oyster Recovery and Marsh Stabilization through use of Brood Reefs in the Biloxi Marsh and Chandeleur Sound	Oyster habitat and commercial oyster harvest exists in the Biloxi Marsh and Chandeleur Sound, in southeast Louisiana. Because of the closure of a large shipping channel known as the Mississippi River Gulf Outlet (MRGO) in 2009 surface water salinity appears to have improved in this region for the propagation of oysters. LPBF has released two reports of the evaluation of suitability of oysters in this region (2013 to 2016) and have identified the so-called “sweet spot” for oyster propagation. It appears that massive investments of cultch are being made in this region. Landings from private leases has been very good. However, stocks on the public seed ground are at record lows. One contributing cause of low stocks is likely the seasonally hypoxia observed in Chandeleur Sound. LPBF has discussed this situation with La Department of Wildlife and Fisheries, and it has been suggested that brood reefs would be a key to accelerating the recovery of oysters in this region. A brood reef in this case would be sites approximately ½ acre in size composed of cultch on the bottom and vertical reef material (2-4 ft.) on the perimeter (possibly reef balls). The brood reef would be within the public seed ground and within the “sweet spot” identified by LPBF. The small brood reefs would be “red-lined” for no-harvest. The brood reefs would be aligned in two directions. One set of reefs would be down the salinity gradient. The other would be aligned along the marsh edge and roughly parallel to a zone of uniform salinity at any time of year. These reefs would also be close to the commercial private oyster leases. The brood reefs could develop as sites of concentration of large mature oyster that produce spat. The vertical reef structure provides some insurance the reefs will survive bottom hypoxia. Placement down the salinity gradient is to account for unpredictable seasonal variation in salinity, so that there is some assurance that at least some reef sites will be in an optimum location. LPBF is discussing specific site location with local commercial oyster fishers. The initial program is to place and monitor 20 brood reefs. The land loss of the Biloxi Marsh is largely due to shoreline erosion. Enhancement of oyster propagation through brood reefs should also enhance the shell budget. More shell adds mineral detritus to the marsh, and also provides hardening of the shorelines. Oysters are the key to the longer-term sustainability of the Biloxi Marsh. The Biloxi marsh is identified as a critical landscape feature by the Corps because it helps reduce storm surge in both Louisiana and Mississippi.	St. Bernard Parish	$1,000,000
	Drone and ground based monitoring of Areas of critical land change in Southeast Louisiana	Drone and ground based monitoring of Areas of critical land change in Southeast Louisiana Land change in coastal Louisiana occurs continuously but is temporally and spatially variable. Much of Louisiana is undergoing land change in the form of wetland conversion to open water. However, a few areas are undergoing land gain in the form of open water conversion to wetlands. Two areas where this is occurring are in the vicinity of the Caernarvon Diversion and Mardi Gras Pass. In both cases, the land gain id due to flow of Mississippi River discharge carry sediment that is being deposited in open water which later became vegetated. This process is natural, and critical to understanding the future performance of proposed diversions the Louisiana Coastal Master Pan. There is a need to understand these areas of deltaic land-building to optimize performance of future diversions. High-resolution photographs are useful to map land change but also to map other changes such as vegetation type. Aerial photography is very useful but is not available frequently or is not during the best season to capture the full dynamic of the land change process. Drone photography couple with direct ground-truthing, may provide an inexpensive and highly accurate method to define and change and a new level of spatial and temporal scale. Two target areas are proposed and would include acquisition twice a year for three years. Images would be stitched and georeferenced. Field observations of land-water boundaries and vegetation type will be incorporated into an interpretation within the discharge footprint of the two river outlets. LPBF will provide overall project management and the field collections. LPBF has a high-resolution RTK Trimble Geoexplorer that will be sued for field mapping. LPBF has already produced numerous technical report of hydrology and geomorphology of both proposed areas of investigation. University of New Orleans will provide drone equipment and oversee drone acquisition of photography. UNO’s Canizaro - Livingston Gulf States Center for Environmental Informatics (GulfSCEI) has the capacity for surveying large areas using the SenseFly eBee Plus fixed-wing drone. The drone team has been professionally trained and includes an FAA-certified pilot. The eBee Plus has a maximum flight time of 59 minutes per battery charge and is capable of mapping 2.2 km2 in a single flight at 400 ft altitude. Different sensors are available depending on the purpose of the mission. The standard S.O.D.A. camera can take 20 MP RGB images with a precision of 2.9 cm/px at 400 ft. The 4-band Parrot Sequoia sensor can capture Red Edge and Near IR frequencies (useful, for instance, in determining vegetation quality). Finally, the thermoMAP sensor can use thermal imaging with 0.1 °C, 14 cm/px resolution to sample heat-sensitive targets (e.g. solar installations, anomaly detection, etc.). All flights are digitally planned using the latest eMotion 3 software suite. This means flights can be conducted in any environment so long as an adequate takeoff vector and a suitable landing space are available. Extremely accurate mosaics and 3D point clouds can then be generated using Pix4D software utilizing depth inference and feature detection. These mosaics are fully orthonormalized to correct distortion and the resulting images are suitable for making measurements. Two Dell PowerEdge servers each with 320 GB RAM are setup to efficiently compute and render the image output. The center’s capable machine learning staff can then analyze the resulting images against various artificial intelligence models to find trends, extrapolate patterns, and make predictions. Equipped with these technologies, GulfSCEI can collect samples for a vast range of applications and flight scenarios	Plaquemines Parish and St. Bernard Parish	$528,000
	Assessment of impact and development of advanced monitoring techniques for Chandeleur Islands seagrasses	The Chandeleur Islands, Louisiana lost a total of 271 acres (110 hectares) of seagrass due to oil. This project will continue the assessment of the impact and recovery from oil exposure on seagrasses in the Chandeleur Islands to complement on-the-ground restoration projects, including by determining where seagrass restoration efforts should be focused and how to most effectively monitor success. The rapid loss of seagrass resources on the Chandeleur Islands underscores needs to advance monitoring capabilities through use of emerging technologies to inform restoration efforts and priorities and monitor success. Specifically, this proposed effort will: 1. analyze imagery acquired in 2013-2016 using an object based image analysis approach to determine habitat coverage changes occurring since 2012; 2. collect and analyze sediment and plant for a subset of NRDA sample sites from 2012; and 3. explore advanced seagrass monitoring techniques using emerging technology, including UAS data collection, camera sampling designed for shallow turbid waters, and optical satellite imagery. Components of the methodology used in this effort should be scalable for monitoring other areas.	St. Bernard Parish	$850,000
	Submerged Aquatic Vegetation Enterprise (SAV-E)	We propose a Submerged Aquatic Vegetation (SAV) center to provide nearshore habitat stock. Scalable and flexible, the concept can be adopted across several restoration types, and linked to numerous funds due to implications to wildlife, water quality, shoreline, research, mapping, monitoring, and others. For example, when marsh is created, SAV is often buried in the shallow waters that are replaced with marsh. Both SAV and marsh are EFH for several species and life stages. Perceived as sparsely and erratically occurring for the non-marine species where marsh is created, the impacts to SAV are unmitigated for those actions. So, adding a harvest pre-construction, and/or planting post construction would tie to habitat restoration projects both from NRDA funds, but also with any existing program, so it could be implemented immediately. A suggested primary objective is to establish and maintain a source of SAV species for such use; expand the species being grown (mostly *Vallisneria americana*, which was most damaged by the DWH spill), and maintain a seed source. Specific objectives are 1. Harvest SAV from marsh construction locations prior to marsh construction, and seed from Rockefeller Refuge Ruppia-managed units, 2. Harvest *Ruppia maritima* plants from Rockefeller, and transplant to Jean Lafitte, 3. Maintain SAV in tanks, and propagate with growth chambers, and 4. Provide plant source within 3 years for repeat planting events at Chandeleur Is. and/or Jean Lafitte. This project will also select and initiate annual surveys of a subset of sites for long-term monitoring/observation from those of a recently completed 3-year baseline survey of the northern Gulf of Mexico that included 384 sites with 38% plant presence. This project addresses multiple restoration types including wetlands, coastal, and nearshore; habitat on federal lands; nutrient reduction; water quality; fish and water column inverts; submerged aquatic veg; sea turtles: marine mammals: and birds due to the broad use of SAVs. The activity will address impacts through restoration (create, enhance or restore an injured resource or habitat); protection (shoreline stabilization, remove from threat of other restoration activates and relocate the habitat); maintain and manage the habitat; and education of any targeted group about how SAV tie to all resources damaged. (Update)	Plaquemines Parish	$3,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
USDA-NRCS	Nutrient Reduction Project for the Bayou Folse Watershed Complex in the Barataria Terrebonne Estuary	The primary goal of this project is to protect and restore water quality in the Barataria Terrebonne Estuary. Reducing nutrient loading into impaired watersheds by avoiding nutrient loss through enhanced nutrient management on private working lands including sugarcane, soybeans and grazing operations. Project Type: Nutrient Reduction restoration type Total Funding Requested: $2,500,000 Project Description/Summary This project will restore resources injured by the DWH oil spill as outlined in the DWH PDARP/PEIS following the Natural Resource Damage Assessment process. This project is included within the following restoration goal, restoration type, restoration approach, restoration technique, TIG, and restoration plan: ● Restoration goal: Restore Water Quality ● Restoration type: Nutrient Reduction (Non-point source) ● Restoration approach: Reduce nutrient loads to coastal watersheds ● Restoration techniques: Agricultural conservation practices ● TIG: Louisiana Restoration Area This project will be carried out through a partnership between the USDA-Natural Resources Conservation Service, Barataria Terrebonne National Estuary Program, Louisiana Department of Environmental Quality, Louisiana Department of Agriculture and Forestry-Office of Soil and Water Conservation, and local Soil and Water Conservation Districts. The Barataria-Terrebonne Estuary is a dynamic working system that supports the people of southeast Louisiana and a diversity of flora and fauna. Farmland runoff containing fertilizers and livestock waste is the main source of the nitrogen and phosphorus, which stimulate an overgrowth of algae that sinks and decomposes in the water. The resulting low oxygen levels are insufficient to support most marine life and habitats in near-bottom waters, posing a serious threat to the Gulf's fisheries. However, anthropogenic alterations to nutrient budgets with the estuary are coupled to an array of ecological impacts, and nutrient-induced degradation of estuarine and near-shore marine habits. This project will implement a well-planned and implemented nutrient management strategy to protect and restore this ecologically, economically, and socially important ecosystem. The primary goal for the nutrient reduction project is water quality improvement through nutrient and sediment reduction. The health of the Gulf of Mexico depends upon the health of its estuaries, and the health of those coastal waters is influenced by land uses in the watersheds of its tributaries. In the five Gulf States, over 80 percent of the acreage is in private ownership (USDA-NRCS 2014) and is used for forestry and agriculture. This watershed-scale project restores water quality impacted by the DWH oil spill by reducing nutrients and the sediments carrying them into coastal waters. Runoff from cropland, pasture, grassland, and forest contributes nutrients and sediments that adversely affect the health of coastal waters of the Gulf. The USDA-NRCS will provide technical assistance to voluntary participants (landowners), especially on the most vulnerable acres in the watersheds, to develop conservation plans and would use all available conservation practices typically planned and funded by USDA-NRCS programs. The project proposes to implement clusters of projects within the smallest watershed practicable with the goal of making a measurable difference in water quality at the watershed level. The proposed conservation practices would reduce nutrient losses from the landscape, reduce nutrient loads to streams and downstream receiving waters, and reduce water quality degradation in watersheds that could provide benefits to marine resources and benefits to coastal watersheds. Priority conservation treatment for this watershed would be erosion and sediment control structures on cropland.	Lafourche, Terrebonne parishes	$2,500,000
	Characterization and trends of existing Coastal Louisiana historical data on nutrient enrichment	Louisiana coastal environments are impacted by nutrient inputs and despite nutrient reduction restoration efforts, concentrations of nitrogen and phosphorus in Gulf waters have increased over the last 50 years (Dagg and Breed, 2003). Excess nutrient inputs to Louisiana's coastal estuaries are associated with harmful algal blooms and oxygen depleted waters – "dead zones". Algal blooms and hypoxic zones in turn negatively impact the spawning habitats and food sources on which the region's economically valuable fisheries rely. The annual summer hypoxic zone in the northern Gulf is the second largest human-caused coastal hypoxic area in the world, typically extending from the outlet of the Mississippi River west along the Louisiana and East Texas coastal shelf. Its size is attributed to the amount of nitrate delivered to the northern Gulf from the Mississippi-Atchafalaya River Basin (MARB) in the spring (Turner et al, 2006). In response, the Louisiana Nutrient Reduction Task Force has identified three coastal ecoregions (Upper and Lower Mississippi Alluvial Plains and Southern Plains Terrace and Flatwoods) on which to focus nutrient reduction restoration. While much work has been done on nutrients within the MARB, a lack of information on long-term trends in nitrogen and phosphorus loads and concentrations in Louisiana's coastal waters limits managers' ability to determine the degree to which changes in land use, management practices, and water diversions have had an effect on riverine and estuarine water quality. A recent analysis of nutrient concentrations by the Louisiana Department of Environmental Quality (LDEQ, 2015) identified upland nutrient trends and land use contributions to coastal basins at LDEQ stations. To improve management decisions targeting nutrient reduction efforts, it is critical to determine the status of not just of current nutrient conditions in uplands but also in these coastal environments and whether changes in water quality attributable to restoration activities can been detected over time. Historical monitoring of water quality conditions by LDEQ, US Geological Survey (USGS), US Environmental Protection Agency (EPA), and others in these basins has consisted of sampling data at locations that coincide with streamflow, discrete sampling for nutrients, and continuous monitoring of salinity and other properties. These data will be used to develop temporal and spatial characterizations nutrient dynamics within these near-shore basins. USGS analysts with expertise in advanced trend analyses such as Generalized Additive Models (GAMs) and the Weighted Regressions on Time, Discharge, and Season (WRTDS) method will examine both long-term and more recent changes in water quality over time. The USGS SPARROW (Spatial Regressions on Watershed attributes) model for the Lower Mississippi Major River Basin will be updated with annualized loadings obtained in this effort and used to support on-going targeting tools such as the EPA Risk Evaluation Tool. When used together, trend analysis and the spatial referencing method afforded by SPARROW are powerful data interpretation tools to evaluate the potential effects of nutrient reduction efforts on downstream water quality. Such understanding is critical to successful adaptive management of Louisiana coastal drainage basins and will be a pilot for other Gulf Coast estuaries. By collaborating closely with regional natural resource managers, we can use these results to help target basin locations and characteristics where restoration practices may have the greatest detectable effects as well as locations that are in need of additional monitoring in order to determine nutrient reduction effects.	Terrebonne Parish	$1,200,000
USDA-NRCS	Florida Parishes of Louisiana – Lake Pontchartrain Basin Nutrient Reduction Project	The primary goal is to protect and restore water quality while conserving critical habitat within the Lake Pontchartrain Basin and the lower Louisiana Coastal Zone. The ultimate objective of restoring, protecting, and improving water resources and associated habitat value will be achieved by implementing Comprehensive Nutrient Management Planning and Conservation Practices that will improve waste management on dairy operations in the Pontchartrain Basin. Total Funding Requested: $1,000,000 Project Description/Summary This project will restore resources injured by the DWH oil spill as outlined in the DWH PDARP/PEIS following the Natural Resource Damage Assessment process. This project is included within the following restoration goal, restoration type, restoration approach, restoration technique, TIG, and restoration plan: ● Restoration goal: Restore Water Quality ● Restoration type: Nutrient Reduction (Non-point source) ● Restoration approach: Reduce nutrient loads to coastal watersheds ● Restoration techniques: Agricultural Conservation Practices ● TIG: Louisiana Restoration Area There are over 100 active diaries in the Lake Pontchartrain Basin (which including Tangipahoa, Washington, St. Helena, and St Tammany Parishes). Typically, these dairies are currently managing the waste component of their respective operations through waste treatment systems that were constructed in the early 1990's. The effluent waste application systems of these diaries are obsolete or marginal at best. This program will reduce the discharge of sediments and pollutants from agricultural operations and improve the tributary streams, rivers and groundwater that drain to the Gulf of Mexico. The ecosystems in the project area provide habitat for numerous threatened and endangered plants and animals, which will benefit from the proposed land treatments. The USDA-NRCS will provide technical assistance to voluntary participants (landowners), especially on the most vulnerab le acres in the watersheds, to develop conservation plans and would use all available conservation practices typically planned and funded by USDA-NRCS programs. The project proposes to implement clusters of projects within the smallest watershed practicable with the goal of making a measurable difference in water quality at the watershed level. The proposed conservation practices would reduce nutrient losses from the landscape, reduce nutrient loads to streams and downstream receiving waters, and reduce water quality degradation in watersheds that could provide benefits to marine resources and benefits to coastal watersheds. All Conservation Practices implemented will meet USDA, NRCS standards and specifications. A representative within the NRCS Field Office, LDAF and SWCD staff will provide technical assistance to participants in designing and implementing Conservation Practices and assist in providing follow-up technical assistance to project participants for the duration of the project. The SWCD will maintain all appropriate project records. It is estimated that this would result in the development (or modification) of comprehensive nutrient management plans for 15-20 active dairies within the watershed. Nutrient reductions can enhance overall ecosystem health by benefitting water quality in estuaries that are integral habitat for providing food, shelter, and nursery grounds for many of the Gulf's ecologically and economically important species impacted by DWH.	Tangipahoa Parish	$1,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Water Storm Surge and Flood Backflow Prevention	Water (Storm) Surge and Flood Backflow Prevention-- In areas with levee protection and pumping stations, this patented system can prevent flooding of inhabited areas, levee overtopping, and washed out or inoperative pumping stations caused by hurricanes, heavy rain events or storm surge in conjunction with rising sea levels. This system includes variable speed drive pumps to adjust pump power needs to the storm severity and has automatic shutoff valves which adjust to tide, and surge levels attached to an alternate bypass system that allows continuous operation even under heavy surge and or tidal conditions. Also allowed is the ability to pump water into existing aquifers during storms or during routine exercising of the pump system resulting in an environmentally sound replenishing of valuable aquifer levels. Project Type Project /Resource Acquisition Time to Complete Project 12.00 months Project Costs Total Project Cost $1,250,000 Requested Amount $100	Orleans Parish,Jefferson Parish	$1,250,000
	Oil Containment Barrier Boom	Oil Containment Barrier Boom for Shorelines/Marshes/Wetlands (Patents No. US 8,696,243 B2) Project Information Project Title OIL CONTAINMENT BARRIER BOOM & SURGE/FLOOD BACKFLOW PROTECTION Project Address or Location TEXAS WATERWAYS AND GULF OF MEXICO SHORELINE Congressional District Watershed/Basin COASTAL Project Summary Project #1 & 1a --- Boom Barrier Containment I & II existing Patents constitute a 95% recyclable system to trap, absorb and detoxify floating oil or hydrocarbon products preventing entry into marshes, wetlands and shorelines and damage to the habitat. This product is placed along shorelines with varying depths and slopes or as a flotation device. This is a Bermuda straw bale wrapped in burlap with an optional cork bottom and a hinged double wrapped filter oil blanket that can be deployed in an extended mode preventing oil and tar balls from going over and or under the Boom Barrier. These 36 inch modules can be quickly deployed by shallow draft work boats and linked together to form a linear or curvilinear barrier along shorelines of all contours and depths. This concept prevents destruction of plant and wildlife at and beyond shorelines, wetlands, and the marshes while utilizing oil eating microbes within the Burlap to naturally biodegrade the trapped hydrocarbon material. This product becomes part of the landscape and does not transfer trapped material to the environment, even if the product is washed away by a hurricane. The plan is to manufacture and stock these bales in strategic locations so that distribution occurs expediently after a spill. This is a unique and natural way to save the coast, waterways, shorelines and beaches from contamination and prolonged cleanup after an event. Project /Resource Acquisition Time to Complete Project 12.00 months Project Costs Total Project Cost $1,250,000 Requested Amount $100		$1,250,000
	Open Ocean Deepwater Fauna of the Northern Gulf of Mexico: Assessment of Intermediate Trophic Level Fishes and Invertebrates	The project assesses the relative abundance and distribution of Gulf of Mexico outer-continental shelf and deep ocean fishes and invertebrates; specifically intermediate trophic level fauna (typically mesopelagic species) that constitute the prey base for various species addressed by NOAA/NMFS management objectives (e.g., cetaceans, sea turtles, billfishes, tunas, coastal migratory species, sea birds). The proposed project fills a scientific data gap addressing open-ocean ecosystem modeling for intermediate and high trophic level species; currently there are on-going projects addressing mesotrophic nekton and high trophic level predators (e.g., cetaceans), however, intermediate trophic level species that are the predator/prey link are not research objectives. DWH injury is demonstrated by overlap between the DWH oil spill and intermediate fauna distributions (fishery independent surveys NOAA/NMFS/ Mississippi Laboratories (MSL); http://spo.nmfs.noaa.gov/mfr724/mfr7242.pdf). The likelihood of success is high considering MSL has an extensive history of outer-continental shelf and deep ocean faunal assessments (bottom and mid-water trawling), and is well-staffed for scientific, vessel, gear and IT specialists. Mid-water trawling for intermediate trophic-level fauna will be conducted both on the continental shelf and in deep ocean and will include, in part, areas with high trophic level species that prey on intermediate trophic level fauna; Bluefin Tuna spawning and large cetacean aggregation areas (B, C, attached chart); the area of DWH surface oiling overlaps the proposed survey area. The annual project satisfies a Restoration objective for sentinel sight monitoring since population dynamics of the intermediate trophic level fauna can be used as a metric for assessing effects of future episodic oil spill events and for Gulf of Mexico ecosystem management related to the causes of population changes for high trophic level species. The survey also provides numerous sampling opportunities for trophic level stable isotope analysis and biological tissue sampling related to the residual effects of the DWH oil spill. There are several applicable sections of the PDARP/PEIS Comprehensive Restoration Plan Section 5; of particular importance is Restoring Natural Resources, Alternative A: Comprehensive Integrated Ecosystem Restoration (5.5), fish and invertebrates (5.5.2), mesophotic communities (5.5.13), sea turtles (5.D.4.6), cetaceans (5.D.5.3) and sea birds (5.D.6.1.1).		$6,802,240
	Big Fish: Cooperative monitoring and restoration of a regional network of multi-species fish spawning aggregations	The wider Gulf of Mexico (GOM) supports the livelihoods of tens of millions of people that depend directly or indirectly on commercial and for-hire recreational fisheries and marine tourism industries worth billions. The GOM includes a vast and complex network of habitats and ecosystems that are vastly productive yet vulnerable to natural and anthropogenic stressors. Restoring and maintaining the sustainability of the system requires understanding the interconnections between species, habitats and ecosystem processes that are not well understood presently. Most of the valuable fishes harvested by commercial and recreational fisheries include groupers, snappers, drums and croakers. All of these groups reproduce in multi-species fish spawning aggregations (FSAs). FSAs serve as productivity hotspots: small areas of the ocean that are dictated by the interactions between physical forces and geomorphology that attract multiple species to reproduce in large numbers. These marine oases also attract a wide diversity of apex predators that feed on aggregating fishes and planktivores that feed on the highly concentrated source of protein-rich eggs. The objectives of the proposed program are to provide quantitative monitoring of multispecies FSAs in both inshore and offshore environments and to use those data to assess the impacts of natural and anthropogenic stressors on these habitats. The research will clarify the role of FSAs as nexus points that are critical to unlocking a more holistic understanding of ecosystem structure and function, species and habitat connectivity, and recruitment and productivity of key species in the GOM. We propose to establish 10 sentinel sites in the waters of the US, Cuba, Mexico and Belize. Sites will be selected from those that are already known and characterized, where local teams are in place to lead monitoring and where intensive research will rapidly inform managers. These will include both snapper/grouper FSAs on offshore shelf edges, and croaker/drum FSAs in coastal estuarine passes. Sites will be monitored continuously and simultaneously following a comprehensive and standardized protocol for the GOM that we developed with RESTORE funding. Monitoring will include a combination of advanced (e.g. hydro-acoustics, passive acoustics, telemetry) and traditional (underwater surveys, biological sampling, genetic analyses, data sondes) approaches to quantify and characterize the timing, abundance, size structure, movement patterns, reproductive activity, productivity, connectivity and distribution of fishes in relation to physical and environmental variations. As part of these efforts, all sites will be instrumented with a suite of in situ biological and physical oceanographic monitoring equipment (e.g. acoustic data loggers, VR2Ws, ADCPs. We hypothesize that protected, multi-species FSA sites will demonstrate measurable increases in the number of species and the number of individuals of each species that reproduce there, thus maximizing reproductive output. This proposal supports most of the main goals of the NRDA Trustees including restore and conserve habitat, replenish and protect living coastal and marine resources, provide and enhance recreational opportunities, and provide for monitoring and adaptive management. The proposal also supports exploration and characterization of new sites. The project will be led by a diverse group of co-PIs representing private business, federal government, and academia from the wider GOM. By working cooperatively with stakeholders from multiple countries including fishermen, managers and scientists, and broadly sharing results via multi-media communications we will engender shared ownership of this long-term, large-scale applied research and management program. This integrated ecosystem restoration approach will translate results into actionable policy recommendations to protect spawning fish and contribute to marine ecosystem resilience.	USA, Cuba, Mexico, Belize	$20,000,000
	Capacity and infrastructure development to support research, education, and restoration activities for mesophotic and deep benthic communities	The trustees should evaluate the full range of options for providing or developing the capacities and infrastructure necessary to implement the programmatic scope of research, education, and restoration activities anticipated for mesophotic and deep benthic communities under the DWH NRDA. These range from acquiring short turn-around capabilities through the development of scopes of work and bid packages to provide on-the-spot contracted vessel, instrument/vehicle, personnel, and shore-side data processing/lab support for high priority actions such as wide-ranging, high-resolution bathymetric habitat mapping and ground-truthing, to undertaking longer-term planning, engineering and design, and build-out/retrofit of purpose-built infrastructure (vessels, other offshore working platforms [e.g., from dynamically positioned ocean-going barges to platforms like the MDA/USN's SBX-1], ROVs/AUVs, technical/saturation diving teams and equipment, submersibles, moored buoy arrays, cabled instrumentation arrays, shore-side research and or education/science interpretation center(s) and personnel, submersible technology or coral propagation facilities and personnel, etc.) for work that will continue through the multi-decadal lifespan of the DWH restoration. This evaluation should give consideration to the potential to sequence sourcing these capacities and infrastructure and should incorporate existing inventories of assets with potential for application such as those identified in NOAA's 2016-2019 DSCRTP Priority Scoping Workshop Report, as well as existing, underutilized facilities throughout the region (e.g., former TMMSN facility footprint adjacent to FGBNMS headquarters and neighboring vacant TAMUG Fort Crockett campus). This evaluation should also consider needed capacities that are minimal or lacking regionally or entirely, such as mesophotic or deep-sea coral, sponge, or benthos community taxonomic or genetics expertise, and should provide for the means to develop those capacities at the scale needed to fulfill the ecosystem-scale goals of the DWH restoration.		$50,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
Flower Garden Banks National Marine Sanctuary (FGBNMS)	Implementation of Flower Garden Banks NMS Management Plan	As outlined in the DWH PDARP, a potential restoration strategy is the establishment of Marine Protected Areas. In 2012, the Flower Garden Banks National Marine Sanctuary (FGBNMS) released a Management Plan, within which Action Plans (APs) outlined activities supporting the existing areas within the FGBNMS, as well as APs for Sanctuary Expansion, Education and Outreach, Research and Monitoring, Resource Protection, Visitor Use, and Operational and Administration. Potentially relevant DWH restoration activities were included within these Action Plans. Since the release of the 2012 Management Plan, the FGBNMS has actively pursued the Sanctuary Expansion AP, through the release of a Notice of Intent, and subsequent Draft Environmental Impact Statement (DEIS) which includes five alternatives for Sanctuary Expansion. As a direct result of DWH, the scope of the potential Sanctuary Expansion as outlined in the DEIS was increased to include mesophotic habitats directly impacted by DWH, as well as regional mesophotic and deepwater coral communities threatened by the event. Alternative 5 is identified in the FGBNMS DEIS as the environmentally preferred alternative, and while the agency's Preferred Alternative identified in the DEIS was Alternative 3, this was limited based on current FGBNMS operational capacity. The Action Plans identified in the 2012 Management Plan are directly relevant to the management of an area such as identified in Alternative 5 of the DEIS. It is important to note that the sanctuary's current management paradigm relies heavily on extramural partnership and funding support for the implementation of the sanctuary action plans, and we anticipate this will remain the case in any potential expanded sanctuary. The DWH NRDA trustees should consider partnering in and providing funding support to implement any actions from the sanctuary management plan that are relevant for DWH restoration, both in the current sanctuary and in any potential areas to which the boundaries may be expanded. The annual cost of implementation of Alternative 5 is estimated at $7M. For sake of discussion, we have estimated the costs forward for 10 years and estimated expected level funding of the current sanctuary at approximately $1,000,000 per year.		$70,000,000
	Marine Mammal Aerial Outreach Banners	The use of aerial banners (small plane pulling long banner) to relay important educational messages to target audiences has proven an effective outreach tool; banners can be used to educate beach-goers and motorized & non-motorized (jet skis, surfers, paddle boarders, etc.) vessel operators about presence of marine mammals and laws protecting them in the Southeast U.S. This project will reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities because target audiences will become aware that these activities are harmful and illegal. The project may also reduce injury and mortality of marine mammals from vessel collisions by making vessel operators aware of the presence of whales and way to avoid vessels strikes. A banner with the message "Don't Feed Wild Dolphins, It's Illegal" has been flown over areas where this harmful and illegal dolphin interaction is known to occur but also in areas where there are large numbers of tourist. These banners have reached over 300,000 people during one flight alone; this is common during spring break and other peak seasons. Banners have also been used when whales are seen close to shore and in areas where there are large numbers of motorized or non-motorized vessels near whales; the banners have made vessel operators aware of the presence of the whale(s) to avoid vessel strikes and harassment. This project involves flying aerial outreach banners in 10 coastal areas throughout Texas, Louisiana, Mississippi, Alabama, and Florida where illegal feeding and harassment activities are known to occur. The customized banners will educate people below to make them aware that these activities are harmful and illegal. Banners will be flown on 10 days each year per location; season, historic tourism numbers, and events will be considered when choosing which days, the banners are flown. Banners would also be flown at times when other marine mammals (i.e. orcas, Bryde's whales) are seen within practical flight distance from shore and in areas where vessels are near to inform those vessel operators of the presence of whales and tips on how to avoid them.		$180,000
	Printing and Distribution of Marine Mammal Conservation Outreach Materials & Signs	Partners currently assist NOAA Fisheries with the distribution of dolphin conservation outreach materials and signs installation throughout the Gulf States. While these efforts are appreciated, outreach is inconsistent and often opportunistic; therefore, lacking in many areas. This project would fund a full-time educator (2 years) to implement a thorough distribution plan and coordinate the installation of 800 dolphin conservation signs throughout Texas, Louisiana, Mississippi, Alabama, & Florida. The educator would document all distribution efforts and plot the installation of all signs on a map. By distributing outreach materials at fishing piers, marinas, businesses, tourism & education centers and at events, and by installing signs on waterways, piers, docks, and in marinas, this project will: - Reduce injury and mortality to bottlenose dolphins from hook-and-line fishing gear by educating fisherman about ways to avoid interactions with dolphins while fishing and provide them with Dolphin Friendly Fishing Tips. - Increase bottlenose dolphin survival though better understanding of cause of illness and death as well as early detection and intervention of anthropogenic and natural threats by informing audiences about how to help a stranded, injured or entangled marine mammal and to report these animals to the appropriate stranding network immediately. - Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities because audiences will better understand the harm and consequence of these activities. They will learn how to recognize dolphin behaviors that are signs of harassment and also how to responsibly view dolphins in the wild. - Reduce injury and mortality of marine mammals from vessel collisions by educating mariners about marine mammal viewing guidelines and precautions they can take to avoid vessel strikes. Outreach materials include: (pdf of these materials: http://sero.nmfs.noaa.gov/protected_resou rces/outreach_and_education/index.html) - Protect Dolphins brochures - Southeast U.S. Marine Mammal and Sea Turtle Viewing Guidelines brochures - Marine Mammal Viewing Guidelines/ How to Help a Stranded Marine Mammal cards - Dolphin Viewing Guidelines stickers - How Can You Help a Stranded Marine Mammal? Southeast U.S. Marine Mammal Stranding Network brochures - Dolphin & Whale 911 App/ SEE & ID Dolphins & Whales App cards - Dolphin Friendly Fishing and Viewing Tips/ Don't Feed Wild Dolphins cards - Cast with Care cards and stickers Signs include: (pdfs of these signs: http://sero.nmfs.noaa.gov/protected_resources/section_7/protected_species_educational_signs/index.html) - Save Sea Turtles and Dolphins - Help Stranded Marine Mammals - Protect Wild Dolphin (Harassment) - Don't Feed Wild Dolphins - Dolphin Friendly Fishing Tips		$275,000
	Protect Wild Dolphin Billboards	This project will reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities because residents and visitors would become aware that these activities are harmful and illegal. Billboards would be used to reach large audiences with important educational messages on highly traveled roads taken by residents and visitors to coastal areas throughout Texas, Louisiana, Mississippi, Alabama, and Florida. Billboard advertisements have the largest impact on the greatest number of people and are the most cost-effective method for reaching target audiences. This project includes design, print, install, and rent for media space for billboards. Billboard would convey brief but important educational messages and images about the harm in illegally feeding and harassing wild dolphins. Locations of 20 billboards will be determined by traffic patterns and distance to popular coastal area where illegal feeding and harassment has been known to occur. Billboards will be maintained in these 20 locations for 2 years to ensure constant and consistent educational messaging in a cost-effective manner.		$530,000
	Marine Mammal Conservation Print Ads in Tourism & Trade Magazines	Print ads in tourism magazines can sometimes be effective in reaching large audiences with the desire to interact with marine mammal in the wild. Unfortunately, magazines offering discounted or probono ad space usually means small ads in the back of a magazine that will most likely be overlooked. This project includes funding a contract with a marketing agency to produce and coordinate full or half page color ads with premium locations within the tourism and trade magazine that are widely distributed throughout Texas, Louisiana, Mississippi, Alabama, and Florida. Large colorful ads would attract readers and ensure these important messages are conveyed to target audiences. By choosing tourism and specific trade magazines to reach target audiences, this project will: - Reduce injury and mortality to bottlenose dolphins from hook-and-line fishing gear by educating fisherman about ways to avoid interactions with dolphins while fishing and provide them with Dolphin Friendly Fishing Tips. - Increase bottlenose dolphin survival though better understanding of cause of illness and death as well as early detection and intervention of anthropogenic and natural threats because this audience would know how to help a stranded, injured or entangled marine mammal and to report these animals to the appropriate stranding network immediately. - Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities because audiences will better understand the harm and consequence of these activities. They will learn how to recognize dolphin behaviors that are signs of harassment and also how to responsibly view dolphins in the wild. - Reduce injury and mortality of marine mammals from vessel collisions by educating mariners about marine mammal viewing guidelines and precautions they can take to avoid vessel strikes.		$500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Dolphin Conservation Mobile Education/ Outreach Exhibit	This project involves developing a mobile outreach and education exhibit that would travel throughout the Gulf States to educate residents and visitors about dolphin conservation issues. The audience includes recreational fisherman, beachgoers, motorized and non-motorized recreational vessel operators, and the general public. By educating these audiences and distributing outreach materials at fishing piers, marinas, and events, this project will: - Reduce injury and mortality to bottlenose dolphins from hook-and-line fishing gear by educating fisherman about ways to avoid interactions with dolphins while fishing and provide them with Dolphin Friendly Fishing Tips. - Increase bottlenose dolphin survival though better understanding of cause of illness and death as well as early detection and intervention of anthropogenic and natural threats because this audience would know how to help a stranded, injured or entangled marine mammal and to report these animals to the appropriate stranding network immediately. - Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities because audiences will better understand the harm and consequence of these activities. They will learn how to recognize dolphin behaviors that are signs of harassment and also how to responsibly view dolphins in the wild. - Reduce injury and mortality of marine mammals from vessel collisions by educating mariners about marine mammal viewing guidelines and precautions they can take to avoid vessel strikes. A large van would be purchased and wrapped with colorful, eye catching dolphin graphics and bold educational messages. Not only would this attract people during outreach, but the wrap would also serve as a rolling billboard that has the potential to reach thousands when traveling throughout the Gulf States. The inside of the van would be a customized exhibit illustrating and educating audiences about the topics above. The budget includes funds to purchase and customize the vehicle, as well as funds for salary of an educator/driver, fuel, per diem (food/lodging), outreach materials, and insurance & maintenance of the vehicle for at least 3 years.		$500,000
	40 Meters and Landward: Assessment, Monitoring, and Adaptive Management for Gulf of Mexico Coastal Ocean, Estuarine, and Riparian Habitat	This project uses novel satellite technology to provide classified habitat shoreward of approximately 40 meters water depth across the Gulf of Mexico. Because satellites pass over any location regularly, this unique project will create a time series of spatial habitat data thus allowing rapid identification of where and when change occurs. Such data are invaluable for effective, targeted restoration planning, project monitoring, and observing how the region responds to a variety of pressures. Many open ocean fish, invertebrates, marine mammals, and turtles injured during Deepwater are dependent on both nearshore and estuarine habitats. Indeed, central to many restoration planning discussions leading to the PDARP were the linkages between offshore and nearshore or estuarine habitats. This is because the most viable - and pragmatic - open ocean restoration often has a nearshore or estuarine focus. However, nearshore and estuarine habitats were also injured by the Deepwater Horizon oil spill and are further degraded by channelization, energy development, subsidence, and sea level rise. These processes will present challenges into the foreseeable future. Mitigating such losses - or even reversing them - would be most effectively achieved if one understands how and where change is most rapid. Advanced satellites now offer the capability to rapidly collect bathymetric and categorical habitat data to water depths as deep as forty meters. This capability means that broadscale maps of habitat and bathymetry covering large swaths of the continental shelves can be developed quickly and efficiently. Further, repeated satellite passes over any given area allows one to measure habitat and landform change through time. These techniques offer distinct advantages in coverage and speed over the piecemeal approaches deployed today that use aircraft, sidescan and multibeam sonars. The work will provide refined habitat data for the Gulf of Mexico, support improvements in circulation models that all rely on bathymetric data and offer a means to monitor change in critical habitat from 40 meters up into terrestrial environments across the Gulf of Mexico. This project will use recent developments in satellites and classification analyses to provide habitat-categorized maps of the coastal zone (inshore of the riparian out to a water depth of 40m depending on water quality). The satellite-derived timeseries of habitat data will be examined to identify those areas that are stable and those that are undergoing rapid change in elevation of habitat type. The information will be useful for states planning geoengineering, restoration personnel preparing for marsh and seagrass projects, and biologists interested in the habitats of fishes, cetaceans, and turtles.		$5,000,000
	Gulf of Mexico Molecular Biology Initiative	Establish a regional laboratory that focuses on providing enterprise-level, high-throughput molecular biological analytical services to support southeast region environmental management programs. The laboratory would serve as a Center of Excellence, regional resource, and collaborative partnership/focal point for federal, state, and local governments, academic institutions, and the private sector. This project would offset reductions in employment owing to the Deepwater Horizon oil spill, reduce the costs associated with processing environmental samples to support restoration and resource management, and serve as a center of advanced technologies in the region. Molecular biology (which involves such areas as Environmental DNA, RNA:DNA ratios, mitochondrial DNA for close kin analyses, DNA barcoding for identifying species, stomach contents, invasive detections, etc.) has become a mature and important transformational technology that is underutilized in fisheries and the southeast. These techniques can help streamline species identifications, reveal the actual species a given animal has consumed, assess the physiological condition of an organism, estimate how many females contributed to a given year class and perhaps what the population size is. They can allow us to monitor changes in diversity, shifts on gene frequencies arising from climate-drive selection, and provide better information on just what lives in the Gulf ecosystem (i.e., we don't know all the vertebrates that occur in the Gulf, let alone the inverts). These products are the core informational needs required for Ecosystem Based Fisheries Management, the development of food webs and useful ecosystem models, and detecting the impacts from accidents and climate change. This information would enable much more advanced approaches to restoration, monitoring, and ecosystem status. The primary objective of this project is to establish a regional capability – a dedicated laboratory - similar to that provided by the Canadian Centre for DNA Barcoding. The project would be a partnership across stakeholders and would have as primary missions: 1. advancing the technological capabilities of the region; 2. integration with marine, estuarine, and coastal monitoring, assessment, and management programs; 3. achieving cost reduction and better data for monitoring programs; and 4. training to move the southeast region to the forefront of applied environmental molecular biology in the United States.		$50,000,000

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	Developing innovative soundscape metrics for tracking the health of deep-sea coral communities in the Gulf of Mexico	The Deepwater Horizon spill event was responsible for changes at all levels of the Gulf of Mexico large marine ecosystem, leading to shifting baselines within these environments. The short-term impact of the spill on deep-sea coral (DSC) habitats has been well documented. However, uncertainty remains regarding the long-term dynamics and ultimate recovery of populations and communities. Establishing the baseline health DSC remains a primary goal, and the appropriate tools used to quantify health continue to be developed. DSC that were impacted by the spill are slow growing, with some estimated to be > 500 years old, and require long time scales for recovery. Understanding the response of DSC and associates to disturbance is necessary to successfully develop restoration efforts that will assist in the ecological recovery of the Gulf. Moreover, there is an immediate need for innovative tools to rapidly assess future impacts. DSC are remote, difficult to sample, and require specialized gear to investigate. Visual surveys and discrete collections at deep reefs are time consuming and spatially and temporally limited. An alternative approach used to monitor shallow-water coral reef environments is the characterization of reef soundscapes. Reef organisms create sounds, which can indicate the presence of particular taxa and of specific biological processes (e.g., spawning, foraging behavior). Linkages among sound, coral cover/species richness and fish assemblages have been observed for shallow reefs, where the diversity of sound types may serve as a proxy for reef fish assemblage structure. In addition, acoustic diversity indices, which essentially reduce complex acoustic data to discrete metrics, have been used to infer community biodiversity. Soundscape measurements and acoustic diversity indices for DSC habitats do not exist. Monitoring the soundscape produced in healthy and impacted coral habitats in concert with visual surveys of the benthic community will help establish the relationship between reef sounds and community assemblages, with the potential to detect habitat changes and track coral health over different temporal and spatial scales. This project will combine visual observations, acoustic monitoring, and develop acoustic indices to elucidate the health, recovery, and resilience of deep-sea coral habitats for the first time. Research will focus on the deep-sea coral reefs formed by Lophelia pertusa (400-600 m), and the coral gardens formed primarily by Paramuricea biscaya (> 1000m). Lophelia pertusa reefs have a similar structure to the shallow-water reefs where acoustical monitoring has been applied, while the deeper coral gardens are the locations of the most severe impacts of the DWH spill. The objectives include characterizing the soundscape at healthy and impacted DSC habitats by (a) measuring the temporal, spatial, and spectral pattern of the acoustic environment at different scales (short vs. long-term, within and among sites) and (b) testing existing acoustic diversity indices and developing new indices based on measured soundscapes to help infer community biodiversity. Visual surveys quantifying the benthic community structure and abundance will be compared to the acoustic surveys in order to assign identity to the various contributors to the soundscape at deep-sea coral sites. Instruments will be deployed for short (1 week) and long (1 year) term data collection and will be redeployed up to 4 times. Instruments may be deployed on other landers monitoring the oceanographic conditions around the impacted corals. For more information, see project submission entitled: Constraining the oceanographic conditions and food supply at deep-sea coral habitats (USGS-Demopoulos). An ROV is required, but ship/ROV operations can be conducted with other deep-sea coral studies. Costs ($5.5M) include instrumenting 6 landers, maintenance for recovery/deployment, shiptime (1x15 day ROV cruise/yr, 5 cruises), and analysis.		$5,500,000
	Documenting temporal change in deep-sea coral sediment community structure and function in order to track long-term responses to natural and anthropogenic disturbance and inform future restoration activities	Benthic fauna provide essential ecosystem services, including nutrient cycling, biomass production, and sediment bioturbation, and a loss of benthic biodiversity has been correlated with an exponential decline in ecosystem services. Sediment macro- and meiofauna (infauna) represent important indicators of natural and anthropogenic disturbance primarily due to their sedentary lifestyle and their rapid response to change; thus, examining these communities has proven useful in impact assessments of coastal and deep-sea communities. For example, in the wake of the DWH oil spill, immediate impacts were detected in benthic communities including sediments adjacent to deep-sea corals. Annual collections of sediment adjacent to the impacted corals are tracking changes in these communities with time since the spill (2010-2016). While long-term impacts to these habitats are unknown, recovery rates are predicted to be slow with DWH derived contaminants remaining in biologically active sediments for many years. Coral-associated sediments contain benthic communities that differ from other soft sediments in the GoM, and thus recovery trajectories at these locations may differ as well, making regional generalizations inaccurate. Without the knowledge of the natural trajectory for recovery of communities, we will be unable to apply remediation tactics to restore these habitats. This research will characterize infaunal community structure at several deep-sea coral sites. Sediment cores will be collected adjacent to corals to assess infaunal abundance, diversity, evenness, and composition in ecosystems affected by different stressors. Sediment also will be processed for total organic carbon and nitrogen, hydrocarbon and metal concentrations, particle size analyses and redox conditions. Similarities and differences in benthic communities will be examined using non-metric multidimensional scaling; pairwise comparisons will be made between sites in order to estimate the percent comm unity dissimilarity/similarity and the taxa responsible for differences among coral sites. RELATE and DISTLM multivariate statistics will be used to analyze and model the relationship between the infaunal assemblage data and the environmental variables. This work will provide traditional taxonomic data that is comparable to existing datasets available at impacted and non-impacted deep-sea coral sites, and regionally for northern GoM soft-sediments, and natural hydrocarbon seeps including the environmental parameters for these habitats. This work also links to proposed research examining the environmental sequencing of sediment communities entitled: Develop rapid response techniques and advanced technologies to enable rapid assessment of deep-sea coral community ecology (USGS-Demopoulos). These comparisons will quantify community changes since the spill, estimate resilience, and determine whether these systems have recovered to comparable community structures near healthy reference areas. Assessing the community composition and biodiversity at selected deep-sea coral sites will provide baseline data for community response to contaminant exposure and critical data for future restoration projects. The cost of this effort is directly related to the number of sites examined and temporal frequency of collections. Initially, this work will investigate 3 impacted and 3 healthy deep-sea coral environments where baseline information exists, on 1 cruise/year for 5 years. Other costs will include expenses for sample processing and data analysis. Additional funding would allow this work to include additional monitoring sites, including areas adjacent to coral transplants and within protected areas, which would require additional support. An ROV is required, but ship/ROV operations can be conducted in concert with other studies examining these environments. Costs, including ship time: $10M total for 5 years.		$10,000,000
	Constraining the oceanographic conditions and food supply at deep-sea coral habitats	Deep-sea environments and the Mississippi River watershed are physically, chemically, and biologically linked. Whether changes to the Mississippi River watershed will lead to improved health of downstream deep-sea ecosystems is unknown and requires long-term monitoring. This study will provide a unique and future-focused approach to assessing the recovery and restoration of impacted deep-sea coral habitats. Organic input from surface waters (food supply), specific hydrodynamic characteristics (e.g., current regime), and other abiotic and biotic factors are believed to limit distribution of these high-density, high diversity communities. Specifically, near-bed currents can inhibit sediment deposition on corals and provide the food that corals need for survival. Changes in phytoplankton production in the upper water column may influence deep-sea coral communities, including survival, growth, and reproduction. This work seeks to understand the environmental baseline conditions necessary for the long-term resilience of deep-sea coral sites, including ocean circulation, surface production, organic flux to seafloor, and larval supply. The research will quantify and measure temporal changes in the hydrological conditions around the impacted and reference deep-sea coral habitats through the use of instrumented moorings, and utilize biomarkers to track changes in nutrient dynamics, including variations in quality, quantity, and source (e.g., whether surface-derived or from seeps). Instrumented moorings will be deployed at the impacted and reference sites, adjacent to deep-sea coral habitats, in each of the five study years. Each mooring will be equipped with a rotating sediment trap to preserve particulate material, including coral larvae, at monthly intervals, an Acoustic Doppler Current Profiler (ADCP) to measure the speed and direction of ocean currents, and CTD with dissolved oxygen optode and chlorophyll (CDOM) fluorescence probe providing continuous records of physical properties (e.g., temperature, salinity, DO) for 5 years of the study. Other instruments may be included for additional costs. The deployment and recovery of the moorings will follow protocols developed by the PIs for deep-sea studies in the GoM, Mid-Atlantic Canyons, and the Caribbean. Sediment trap samples will be processed for zooplankton, 210Pb, bulk density, grainsize, % organic carbon, nitrogen, pigments, organic biomarkers, and stable isotopes in order to measure the quality and quantity of organic matter fluxing to the deep sea. This will provide information on the source and variability of food for the corals, as well as identifying the trophic and energetic links form the watersheds to the deep sea. Sediment trap material will also be analyzed for environmental DNA to screen for select GoM taxa (fishes, zooplankton, coral larvae, and microbes). See project description entitled: Temporal dynamics of eukaryotic plankton diversity at northern GOM deep benthic coral communities (USGS-Morrison) for more details. Data from the ADCP, CTD, and sensors will provide monthly measurements of the oceanographic environment. Sediment trap and instrument data will improve understanding of the transport, fate, seasonality, and sources of nutrients to deep-sea corals and associated deep-water circulation that can influence the larval supply to the hardbottom environments. Following this baseline profiling, rapid assessment of changes in nutrient delivery and food sources to the deep sea following human-triggered events will be possible. Costs associated with this project include ship time (1 x 15 day cruise/yr for 5 yrs), instruments and landers, including maintenance costs for each deployment and analyses costs. Total cost: $9M/5 years, with ship time. An ROV is required for instrument placement, but ship/ROV operations can be conducted in concert with other studies examining these environments.		$9,000,000

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	Develop rapid response techniques and advanced technologies to enable rapid assessment of deep-sea coral community ecology.	Deep-sea sediment fauna (infauna) represent important components of benthic biodiversity, and provide essential ecosystem functions including sediment bioturbation, organic matter decomposition, and energy transfer. However, due to their sedentary lifestyles and low mobility, infauna are vulnerable to disturbance, including hydrocarbon contamination and organic enrichment. Impacts associated with contaminants from the DWH spill resulted in changes in infaunal composition, diversity, and abundance. While these data represent a useful baseline for tracking post-spill changes, the long-term response of these deep-sea communities remains unclear. Sediment community assessments have traditionally used taxonomic methods for identification of fauna and diversity estimation. However, these methods are time intensive. Recent advances in high throughput environmental sequencing have enabled assessment of a wide range of metazoan taxa present in deep-sea sediments using molecular methods. Environmental sequencing has been successfully used to assess biodiversity and genetic connectivity of deep-sea and coastal sediment communities and characterize pre- and post-spill beach sites affected by heavy oiling during the DWH spill. Environmental sequencing may elucidate connectivity among GOM habitats, potentially identifying critical habitats for biodiversity maintenance, which is important for successful recovery of impacted communities. Comparison between DNA-based data sets and taxonomic results will provide quantitative metrics to ground-truth the utility of molecular analyses in future rapid assessments. This type of DNA-based method will be useful for understanding the effectiveness of restoration efforts by providing rapid quantification of infaunal community changes with disturbance, and potentially the identification of new indicator species for future disturbance events. Sediment cores will be collected adjacent to deep-sea corals (healthy and impacted sites) and s ediment fractions will undergo standard meiofaunal extraction procedures for both taxonomic and environmental sequencing. Environmental DNA will be obtained from the extract, followed by amplification and sequencing on the Illumina MiSeq platform. This methodology has been extensively tested and validated for high-throughput environmental DNA sequencing. Processing and analysis of high-throughput data will be carried out using the appropriate software tools and bioinformatic workflows. Data collected will represent a combination of high-throughput sequencing methods and traditional taxonomic approaches, providing valuable information from which to track the recovery of impacted deep-sea coral infaunal communities, guide long-term monitoring programs of deep-sea environments, and help inform the development of future restoration plans. Samples collected will be processed for environmental analysis to provide a rapid assessment of sediment communities, to identify changes in their community structure, and to isolate species-specific responses to oil spills versus other types of disturbance. This research will provide the data required for impact assessments and to measure the success of mitigations developed through adaptive management for the protection of natural resources. The cost of this effort is a function of the number of sites examined and temporal frequency of collections. Initially, this work will investigate 3 impacted and 3 healthy deep-sea coral environments where baseline information exists, on 1 cruise/year for 5 years. Other costs will include expenses for sample processing and data analysis. Additional funding would allow this work to include additional monitoring sites, including areas adjacent to coral transplants and within protected areas, which would require additional support. An ROV is required, but ship/ROV operations can be conducted in concert with other studies examining these environments. Costs, including ship time: $11M/5yrs.		$11,000,000
	DWH Long-term Planning Action Analysis: Ocean Use Mapping	Conduct participatory workshops with regional ocean experts to capture community perspectives about ocean space and to create maps of past and current ocean uses across three distinct sectors: non-consumptive, fishing and industrial/military. Develop GIS data, map and analytical products, and web-based interactive viewers to guide NRDA efforts. Benefits: 1. Provides critical information about ocean uses to help guide and prioritize future emergency response and cleanup activities in order to minimize impacts and injuries to users. 2. Captures wide range of community perspectives about ocean space (i.e. how it is used, governed and managed) to complement other mapping approaches designed to document physical ocean features/properties (e.g. species distribution, biodiversity indicators, ecosystem health) 3. Provides a more complete baseline of human uses for future oil spill assessments related to lost use compensation and restoration. 4. Provides a unique and comprehensive planning resource to identify, design, prioritize and evaluate restoration projects for the efficient use of recovered funds aimed at replacing lost uses and values. 5. Provides a long-term information resource to inform broader coastal planning and management priorities that take into account current and emerging ocean uses of the ecosystem, including investment in future recreational opportunities. 6. Provides, for the first time, a comprehensive linkage between ecosystem features, functions and services and the ocean uses they support. 7. Provides the baseline data to explore linkages between existing ocean uses and documented economic values of coastal activities. Products: 1. Spatial GIS data on each ocean use and sector. 2. Analytical products illustrating patterns in ocean use, including identification of existing ocean uses at risk from spills or response activities. 3. Interactive online viewer allowing remote visualization and analysis of GIS data. Desired Outcomes: • strengthened and more efficient planning for emergency response, assessment and restoration. • Interactive holistic mapping product utilizable by multiple planning agencies • Useful mechanism for integration with existing resources • Planning product utilizable across sectors and uses		$3,000,000
	Socioeconomic impact analysis of potential marine protected area implementation	This project will support socioeconomic analyses necessary to evaluate the impact of the establishment and implementation of proposed or potential marine protected areas in the northern Gulf of Mexico. These include the expansion of the Flower Garden Banks NMS and Mesophotic/Deepwater Habitat Areas of Particular Concern (HAPC).		$500,000

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	Broadscale Habitat Mapping and Monitoring of the Northern Gulf of Mexico	Primary objectives are to map and characterize habitats of the U.S. Gulf of Mexico (GOM) from the continental shelf break shoreward to less than 10m depth as well as determining species associations and community structures. Modern technology supported by statistically based ground truthing will be used to supply cost effective determinations of bathymetry and habitat data in U.S. GOM from depths of 500m and shallower. An estimated 10-15% of U.S. waters will be mapped to 500m depth by strip transects spaced approximately every 10km throughout the GOM. Little of the GOM has been mapped with enough resolution to accurately locate and quantify the hard/live bottom habitats as well as artificial reefs. Accurate and comprehensive habitat maps are essential for ecosystem-based fisheries management and marine spatial planning. This project intends to expand upon recent efforts to catalog and prioritize mapping in the GOM with at sea mapping and sampling to fill data gaps and provide region wide assumptions about fisheries habitat, species associations, and community structure. In response to the DWH oil spill, the Trustees determined that injuries to reef fish communities occurred but were not quantified (PDARP 5.5.6.4). Enhanced fishery-independent data collection methods, such as increased spatial and temporal effects for fishery-independent surveys are recommended as part of the Monitoring Plan. It is also noted that "habitat associations could improve restoration outcomes" and "information that increases our understanding of densities of organisms in geography over time, ecosystem functioning, and trophic relationships can be used to inform restoration project planning, design, and evaluation". This project intends to bridge gaps in knowledge on the distribution of offshore habitats and their species associations. Community structure information will be critical in expanding ongoing and future fisheries independent surveys to allow for pre- and post-stratification. By refining surveys by habitat, variance will be greatly reduced for indices of abundance and lead to more accurate stock assessments. A suite of advanced remote sensing technologies will be utilized, including towed and AUV mounted side scan and synthetic aperture sonars, multibeam echosounders, ROVs, and other optical sensors. Mapping in the GOM has increased in the last decade; however, there has not been a unified large-scale effort across the entire depth range of the continental shelf. This project intends to: 1) expand upon current and previous mapping efforts from nearshore to 500m throughout the U.S. Gulf, 2) characterize essential habitats for benthic organisms and their habitat associations, 3) quantify and characterize estimates of hard bottom and artificial reef habitats. Imagery will be used to produce classifications which will be scalable to the Coastal and Marine Ecological Classification Standard (CMECS). In all cases of surface and subsurface mapping, care will be taken to avoid duplication of previous efforts. Deliverables will include completed high resolution habitat maps and GIS products, scalable habitat estimations by region, ground truthing imagery, species/community structure information, and an online data portal to access and download data products. Initial and ongoing monitoring of these systems will support adaptive management strategies and provide more accurate information on landscape scale habitat distribution patterns as well as connectivity throughout the GOM. Stock assessments with detailed information regarding amount, distribution, and contributions of various types benthic habitat will reduce uncertainty as well as allow for more efficient and accurate population surveys. Baseline information will allow for pre- and post- analyses of habitat change due to events such as hurricanes, contaminant spills, coastal erosion, and restoration activities as well as informing decision-making processes of the latest research findings.		$20,000,000
	Open Ocean Deepwater Fauna of the Northern Gulf of Mexico: Assessment of Intermediate Trophic Level Fishes and Invertebrates	The project assesses the relative abundance and distribution of Gulf of Mexico outer-continental shelf and deep ocean fishes and invertebrates; specifically intermediate trophic level fauna (typically mesopelagic species) that constitute the prey base for various species addressed by NOAA/NMFS management objectives (e.g., cetaceans, sea turtles, billfishes, tunas, coastal migratory species, sea birds). The proposed project fills a scientific data gap addressing open-ocean ecosystem modeling for intermediate and high trophic level species; currently there are on-going projects addressing mesotrophic nekton and high trophic level predators (e.g., cetaceans), however, intermediate trophic level species that are the predator/prey link are not research objectives. DWH injury is demonstrated by overlap between the DWH oil spill and intermediate fauna distributions (fishery independent surveys NOAA/NMFS/ Mississippi Laboratories (MSL); http://spo.nmfs.noaa.gov/mfr724/mfr7242.pdf). The likelihood of success is high considering MSL has an extensive history of outer-continental shelf and deep ocean faunal assessments (bottom and mid-water trawling), and is well-staffed for scientific, vessel, gear and IT specialists. mid-water trawling for intermediate trophic-level fauna will be conducted both on the continental shelf and in deep ocean and will include, in part, areas with high trophic level species that prey on intermediate trophic level fauna; Bluefin Tuna spawning and large cetacean aggregation areas (B, C, attached chart); the area of DWH surface oiling overlaps the proposed survey area. The annual project satisfies a Restoration objective for sentinel sight monitoring since population dynamics of the intermediate trophic level fauna can be used as a metric for assessing effects of future episodic oil spill events and for Gulf of Mexico ecosystem management related to the causes of population changes for high trophic level species. The survey also provides numerous sampling opportunities for trophic level stable isotope analysis and biological tissue sampling related to the residual effects of the DWH oil spill. There are several applicable sections of the PDARP/PEIS Comprehensive Restoration Plan Section 5; of particular importance is Restoring Natural Resources, Alternative A: Comprehensive Integrated Ecosystem Restoration (5.5), fish and invertebrates (5.5.2), mesophotic communities (5.5.13), sea turtles (5.D.4.6), cetaceans (5.D.5.3) and sea birds (5.D.6.1.1).		$3,401,120
	Improving restoration for highly migratory species in the Gulf of Mexico: applying innovative technologies to inform stock assessment and establish monitoring	Our project will apply innovative molecular technologies to highly migratory species such as tunas and billfishes to 1) fill significant information gaps in stock assessments thus reducing mortality through enhanced management and 2) develop robust monitoring techniques allowing a rigorous application of the MAM approach to the restoration effort. In order to develop a viable restoration process, we must establish baseline data (i.e., indices of abundance) for target species. Restoration actions can then be monitored against these baseline data and adapted as needed. Highly migratory species are inherently difficult to monitor due to their behavior and ecology, thus baseline abundance data for many of these species in the Gulf of Mexico are lacking. As an alternative to fishery dependent data, multi-year surveys of ichthyoplankton abundance can be used to track temporal changes in adult biomass. We propose to implement innovative molecular techniques in order to identify larvae of highly migratory species (i.e., tunas and billfishes) and develop larval indices for the Gulf of Mexico. We will process older (1982 to 2008) formalin preserved SEAMAP samples by implementing and expanding upon methods that were developed by the Alaska Fisheries Science Center's Auke Bay Laboratory. To process more recent (2009 to present) ethanol preserved SEAMAP samples, we will use high resolution melting analysis (HRMA) combined with a fast, minimally invasive DNA isolation protocol. The application of these innovative molecular techniques to process existing samples is a cost-effective way to develop fishery independent indices of abundance for several highly migratory species, providing an efficient alternative to costly surveys of adult fishes. This project will also serve as an investment in the improvement of future processing. This project will also have direct applications to the restoration. By developing novel larval indices, this project will aid in the reduction of mortality of highly migratory species by enhancing stock assessments, and it will create a historical record against which the restoration of highly migratory species can be robustly monitored and assessed. This project will also allow a more rigorous application of the MAM approach to the restoration effort. We expect this project to advance the utilization of monitoring techniques that can be used to assess future vulnerabilities to anthropogenic environmental perturbations and to enhance regional restoration efforts. This project meets several restoration goals including: (1) Reduce mortality among Highly Migratory Species and other oceanic fishes and (2) develop Monitoring and Adaptive Management techniques.		$5,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Life history, trophic dynamics, habitat utilization, trends in abundance, discards and bycatch reduction of large pelagic fishes in the northern Gulf of Mexico	We propose a comprehensive sampling program for highly migratory species (tunas and billfish) and large pelagic species (mackerel and dolphin fish). Sampling would include a fishery-independent monitoring survey, at-sea observer commercial sampling and dock side/tournament recreational sampling. Two 45-day pelagic longline cruises will be conducted in the northern Gulf of Mexico during the spring and fall of each year. The sampling universe will be defined as waters extending from the 200 m isobath to the furthest extent of the EEZ. Fifteen days of survey operations will be conducted in each of three regions biannually. A stratified random sampling design will be employed based on factors known to cause the patchy distribution of pelagic fishes (e.g., areas of localized high primary productivity and ephemeral oceanographic features). Up to four longline sets will be conducted each day for a total of 40 stations per region or 120 stations per cruise. Data collected during surveys will be used to assess trends in abundance, hook selectivity, effects of soak time/temperature/depth on mortality rates, movement patterns, abiotic factors driving distribution and abundance, species assemblages, relative abundance and habitat preferences. Biological samples will be taken for age and growth studies, otolith micro-constituent analysis, reproductive studies, diet/trophic studies and genetic analysis. Additionally, we will deploy 100 pop up satellite tags on selected species each year to further examine movement patterns, residency times and habitat use of pelagic fishes. There is currently no fisheries independent data to monitor trends in abundance of pelagic fishes. This study would provide these much-needed data and allow for enhanced monitoring of recovery rates of pelagic fishes. Deliverables include indices of abundance, identification of fishing related sources of mortality (at-vessel and post release), information of impacts such as gear selectivity and the effects of soak time, temperature and depth of capture on mortality rates. Knowledge of these impacts will help monitor reductions in bycatch and assist in the recovery rates of impacted populations. Identification of habitat (e.g. spawning grounds), movement and distribution patterns will assist in the recovery process. Biological samples will be used to determine length and age composition, calculate growth curves, estimate maturity and fecundity, estimate natural mortality, identify natal origin and examine food habitats and trophic dynamics. Performance metrics include cruise reports, annual progress reports, SEDAR and the HMS stock assessment reports and the HMS annual Stock Assessment and Fisheries Evaluation (SAFE) Report, as well as through presentations at scientific meetings and peer reviewed publications. The proposed project directly addresses three Programmatic Trustee Goals for Fish and Water Column Invertebrates, as listed in the PDARP, specifically, 1) Replenish and Protect Living Coastal and Marine resources, 2) Provide and Enhance Recreational Opportunities, and 3) Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation.		$35,000,000
	Benthic Invertebrate Community Response and Recovery Rates following Barrier Shoreline Restoration Projects in northern Gulf of Mexico and Potential Impacts to the Habitats of the Threatened Piping Plover (*Charadrius melodus*) and Other	The proposed study would address the RESTORE objective to replenish and protect living coastal and marine resources in the nearshore habitats. Barrier islands provide nesting, foraging, and resting habitat for migratory shorebirds, including two federally listed species (Piping Plover, Red Knot) and numerous additional species of concern. Intertidal benthic invertebrates represent critical food resources for migrating and overwintering shorebirds. Enhancement of barrier island beaches represents an increasingly utilized component of Gulf of Mexico restoration efforts, yet the short- and long-term effects of sediment placement on intertidal invertebrate communities and, in turn, the migratory birds that rely on those communities are not known and thus a cause for concern. There is a current need to understand the factors affecting recolonization by intertidal invertebrate populations and the response by shorebirds following barrier island beach enhancement activities. Understanding the impacts of beach enhancement on the benthic invertebrate prey base, the primary factor limiting migratory shorebird populations, is needed to determine appropriate avoidance, minimization, and mitigation practices. Abundance and composition of benthic invertebrate communities are influenced by numerous environmental factors including microalgae and other food resources, sediment grain size, salinity, and total organic content, all of which may be affected by beach enhancement activities. Sediment placement may negatively affect benthic invertebrate populations by changing sediment characteristics, leading to modification of invertebrate community structure, and by increasing sediment compaction, which may lead to invertebrate mortality and population declines. Published data suggest that recovery of benthic invertebrates may take 6-24 months, or longer, following beach enhancement. Factors affecting benthic invertebrate population recovery, however, likely depend on the sources of app lied sediments, and invertebrate taxa-specific dispersal, reproduction, and recolonization potential. To evaluate relationships among benthic invertebrates (prey), shorebirds (predators), and key environmental covariates (e.g., sediment particle size) in the context of beach enhancement, we will quantify biomass and diversity of intertidal benthic invertebrates and species-specific density of foraging shorebirds as a function of time since restoration and environmental factors. We will use the following suite barrier island study sites in Texas and Louisiana, which vary in time since restoration: Texas Rookery Islands- Dickson Bay II, Dressing Point, Rollover Bay, and Smith Point Islands and the Louisiana Outer Coast Restoration- Shell, Chenier Ronquille, Whiskey and Caillou Lake Headlands, and North Breton Islands. At each study site we will collect benthic samples at randomly placed sampling stations during fall, winter, and spring periods of all years (2018-2020) At each station, 3 types of core samples will be collected: macroinvertebrates, sediment characteristics, and benthic microalgae. Within each sampling station, we will collect benthic invertebrate samples in the midswash zone, which we define here as the wet area of the intertidal zone between where waves break and the leading edge of moving water. Collected sediment cores will be used to measuring variables relevant to invertebrates such as grain size, soil moisture, total organic content (TOC), and salinity. We will survey shorebirds twice each month (alternating weeks) from August through May of both years (2017-2018 and 2018-2019) at each study site. We will identify to species and enumerate all shorebirds encountered within the survey area, and record locality coordinates (latitude-longitude), habitat, and activity for a suite of species that forage in the swash zone. Results of this study may provide adaptive management strategies that can be used to restore shorebird habitats.	Plaquemines Parish, Matagorda County, Galveston County, Chambers County, Terrebonne Parish	$1,470,000
	Establish additional deep-water coral sentinel species and use as: part of a gulf-wide monitoring network, to monitor coral health in protected areas, or to monitor direct coral transplant projects, and/or as tools to detect and quanti	In the aftermath of the DWH spill, several communities of deep-water corals were discovered that had been impacted by the spill. Initial identification and quantification of the impact was difficult because of the lack of background data on undisturbed deep coral communities. Predicting recovery is also hampered by the lack of data on normal deep-water coral recovery patterns and rates. However, an intensive effort aimed primarily at two Paramuricea species has proven the efficacy of using high resolution imaging techniques to document and quantify both impact and recovery of octocorals with this type of growth form. Planar octocorals (including the taxa Calcaxonia, Holaxonia, and Scleraxonia in particular) are excellent sentinel organisms because their morphology allows quantification of impact, they are normally very long lived, their skeleton is normally completely covered with living tissue, their exposed tissues interact directly with epibenthic water for their nutrition and respiratory needs, and since they are attached, damaged of killed colonies remain in place providing a record of deleterious impact that can persist after the affecting agent has dissipated or if no residue is left on the seafloor. The research following the DWH spill, particularly the data from non-impacted communities, has provided sufficient baseline data to establish Paramuricea biscaya and Paramuricea sp. xxx as robust sentinel species for detection of anthropogenic impact. However, to date we have only established monitoring sites in a relatively small area of the GoM and these two Paramuricea species are only present between about 1000 and 1800 m depth. We propose to expand the use of these types of corals to include additional robust sentinel species and monitor other depths and regions of the GoM. In addition to providing robust sentinels for anthropogenic impact at the specific locations chosen for monitoring, this effort will provide the background data needed to use addit ional species across a wide depth range to detect and quantify potential future impacts in other locations and to assess success of restoration efforts with respect to recovery, natural mortality and growth rates. The cost of this effort is scalable depending on the number of new sites established, their depths, whether they are currently well enough known to allow immediate work, and the frequency of monitoring. Discovery of a new site, including confirmation of the presence of corals in a specific area and depth range averages about 4 days of AUV operations at depths of about 1,000m. Establishing a monitoring site, at a known location with over 50 individual colonies to be monitored will take about 2 days of ROV operations. Repeat monitoring of an established site can be accomplished with 24 hrs of ROV operation. A minimum effort to expand the number of known sites with appropriate sentinel species at additional depth ranges would require a minimum of 1 month of AUV operations with a Sentry type of AUV (approximately $1million), followed by one month of ROV operations (approximately $1.6million) to establish the sites and acquire images to initiate the monitoring. A smaller effort aimed at only known sites would not need AUV operations. Repeat visits every 2 -3 years (or when needed), could be accomplished with about 3 weeks of ROV time each (approximately $1.2million). All ROV time should be used collaboratively for other funded sampling of deep-water corals and associated communities. Other costs associated with the data acquisition, processing and analysis specific to this project would be approximately $400K /yr during establishment of a total of about 10 new sites and monitoring of 6 established sites which would decrease to about $300k/yr associated with ongoing monitoring. Additional sites, geographic areas, or intensity within a given area would require additional support.		$4,000,000

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	Integrative Data Infrastructure for Gulf of Mexico Mesophotic and Deep-Benthic Habitat Assessment and Restoration	OBJECTIVES: • Build, enhance, and expand upon existing federal data management infrastructure for mapping, video analysis, and habitat suitability modeling of deep-sea corals to better support understanding and restoration of mesophotic and deep-benthic biogenic habitats. • Support the collection and analysis of new information from Gulf restoration studies and provide tools to guide and help coordinate deepwater surveys and restoration efforts. RATIONALE: Mesophotic and deep-sea coral habitats represent rare, valuable, and vulnerable communities in the Gulf of Mexico. Both mesophotic (50-150 m) and dep-sea coral (1500-1800 m) habitats were damaged during the DWH oil spill and will be a focus of restoration activities. NOAA's Deep Sea Coral Research & Technology Program is Congressionally-mandated inter-alia to: identify existing research on, and known locations of, deep sea corals; map locations of deep sea corals; conduct research on deep-sea corals, including survey techniques. The program works across NOAA Line Offices to implement studies and has developed a national database of deep-sea corals and sponges and an on-line map portal (https://deepseacoraldata.noaa.gov/). The proposed activities support both objectives of the PDARP through data analysis, advanced habitat suitability modeling, and management of relevant data: (1) Protect and manage mesophotic and deep benthic coral communities – The first priority is to understand the current or potential distribution of these communities. (2) Place hard ground substrate and transplant coral – The success of these restoration efforts will depend upon an understanding of the habitat and environmental factors that determine where such restoration activities are most likely to succeed. KEY ACTIONS AND DELIVERABLES: • Establish a Gulf of Mexico Mesophotic and Deep-Benthic Analysis & Data Management Team – Initial focus on Corals and Sponges and associated environmental data layers • Build capacity and supportin g data management framework for image & video analysis of new and pre-existing benthic surveys – including image capture, analysis, and display of density, diversity, presence and absence measures for mesophotic and deep-sea corals and sponges • Develop a DSC Research Clearing House (or link to relevant existing clearing houses) with bibliographies, reports, and data summaries • Enhance the capacity of the Deep Sea Coral and Sponge Database (www.deepseacoraldata.noaa.gov) or develop new database(s) to include additional taxonomic groups and support restoration planning and monitoring. • Develop and support a state-of-the art display for data visualization and analysis (DSCRTP Map-Portal v.2), including interactive graphics and quality assurance tools. This would build on existing data infrastructure to integrate both biological (presence & absence data for coral and sponge taxa) and habitat/environmental data (multibeam mapping layers, habitat suitability modeling, oceanographic conditions). • Establish or enhance interoperability with key NOAA data systems already supporting Gulf science and restoration, including NCEI's Ocean Archive System and Office of Response and Restoration's DIVER system. • Advanced habitat suitability modeling for key taxa of restoration interest (e.g., Coral taxa identified as injured in mesophotic habitats (e.g., Swiftia exserta - Etnoyer et al. 2016, Silva et al. 2015) and deep benthic habitats (e.g., Paramuricea spp - White et al. 2012, Fisher et al. 2014). • Develop additional tools to support restoration o Animal identification guides o Data visualization tools through online map portal o Custom environmental data packages geared towards habitat modelers o Provide climatological values from the World Ocean Atlas or existing models (e.g., ROM, AEC, NCOM) o Provide multi-beam or bathymetric digital elevation models (DEMs)		$10,000,000
	Restoration of Gulf of Mexico pelagic and broad scale fisheries: addressing movement ecology data needs	This project will use multiple tracking technologies, as well as the Integrated Tracking of Aquatic Animals in the Gulf of Mexico network (iTAG-n) and research group (iTAG-r) to collect important data, difficult or impossible to assess with traditional capture-based methods. The focal species will be: yellowfin tuna (Thunnus albacares), greater amberjack (Seriola dumerili), cobia (Rachycentron canadum), red drum (Sciaenops oscellatus), gag grouper (Mycteroperca microlepis) and red snapper (Lutjanus campechanus). The DWH oil spill occurred in the northern GoM during the spring and summer of 2010, which would overlap in space and time with either the spawning or early life stages of these species. This is of special concern with water column pelagic spawners, as where and when they reproduce (i.e., spawn) and consequent dispersal dynamics affect offspring survival in ways not seen in most terrestrial species. In addition, larval cardiotoxicity is documented for several of these species, resulting in heart-related abnormalities that could impact long-term stock productivity, especially in stocks already highly impacted by fishing and anthropogenic stressors. All focal species support important fisheries and are considered overfished, have decreasing landings or stock assessment scientists or fishermen are concerned about the stocks' health. Specific concerns associated with the focal species include: (1) yellowfin tuna landings are decreasing and deepwater oil rigs may change natural migratory behavior and spawning site selection and consequently reproductive success; (2) the greater amberjack stock is overfished and not rebuilding as expected, and there is a need to better understand how artificial reefs affect spawning site selection and fidelity; (3) the recent cobia stock assessment was inconclusive due an incomplete understanding of stock structure and connectivity and fishermen are expressing concern at low catch levels; (4) red drum were affected locally by the oil spill demonstrating anemia and presumed decreased fitness and impaired reproduction but we do not have the needed understanding of spawning migrations and connectivity to assess how this would impact the Gulfwide stock; and (5) both gag grouper and red snapper are assumed to have been impacted by the DWH oil spill—and increased lesions were observed in adult red snapper—but estimates of abundance and measures of recovery are hampered for both species due to a lack of movement data and cryptic mortality which may vary with habitat type, depth, and sex. This study will work closely with fishermen and integrate a series of Gulf-wide tracking projects that focus on evaluating depredation/release mortality and the effect of habitat (natural and artificial) on migratory behavior and spawning site selection. Data on migratory behavior is needed to distinguish between decreases in landings due to changes in catchability associated with changed movement behavior versus lower abundance due to the oil spill and overfishing. We propose to use multiple tagging approaches: pop-up satellite tags, archival implant tags, and acoustic telemetry tags, drawing on both the benefits of large-scale tracking and the higher resolution data obtained through acoustic and archive tags. Data from this project will provide critical information needed to assess the effects of the DWH oil disaster and to predict stock resilience to spatial disturbances in the future. This in turn will support the adaptive management of NRDA fisheries projects.		$5,000,000
	Establishing and monitoring sentinel sites for Gulf of Mexico Coralline Mesophotic and Deep Benthic Communities	Establishing and monitoring sentinel sites is an important Restore Act objective related to assessing long-term effects of the BP oil spill. With regards to Open Ocean Restoration objectives, coralline mesophotic and deep benthic habitats are essential fish habitats for sustaining population vigor for numerous NOAA management species (e.g., groupers and snappers) and those habitats have been identified as principle objectives for the Open Ocean Restoration. Establishing long-term sentinel sites will be based on locations for past study sites (e.g., NOAA FRV OKEANOS EXPLORER projects, RV FALKOR Streich et al. 2017, Kahng et al. 2010, Silva et al. 2016) and from sites assessed during NOAA/NMFS/SEFSC reef fish surveys (video footage, bottom mapping, species diversity). Sentinel sites will be located along the entire Gulf of Mexico outer continental shelf/slope and based on proximity to the BP oil spill location (flanking sites) and the distribution of known coralline deep benthic habitats (areas with more coralline habitat will be proportionally allocated more study sites; also based on sea day allocations). A Remotely Operated Vehicle (ROV) will be used to visually assess habitat characteristics; when possible established abundance assessment methods will be used (e.g., fish MinCount, NOAA/NMFS/SEFSC/Mississippi Laboratories Reef Fish Unit). Past studies that utilized ROVs (e.g., Streich et al. 2017) have established important experimental protocols applicable to the sentinel site proposal. Utilizing a ROV has several advantages; broader areal coverage, no habitat damage, articulating robotic clamps for collecting sessile fauna, accessory components provide detailed fine-scale mapping. The proposed project provides an assessment metric for BP oil spill recovery and future episodic events. Project supports PEIS Comprehensive Restoration Plan Section 5. Restoring Natural Resources; 5.5; Alternative A: Comprehensive Integrated Ecosystem Restoration (Preferred Alternat ive; p 5-20); 5.5.2; Restoration Type: Wetlands, Coastal, and Nearshore Habitats; Key Aspects of the Injury That Informed Restoration Planning; Fish and Invertebrates section (p 5-22).	N/A	$3,712,840

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	Ecosystem restoration by decreasing gulf menhaden catch and effort	The Gulf menhaden is forage for a wide diversity of fish, bird, and marine mammal populations that inhabit the Gulf of Mexico, its estuaries, wetlands and tributaries. Annually, the purse seine fishery targeting this species removes about 1 billion pounds (450,000 metric tons, mt) of living biomass from the ecosystem. While that biomass is dominated by gulf menhaden, substantial quantities of commercially-, recreationally-, and ecologically important species are also extracted as bycatch. In addition, deleterious fishery interactions with protected species occur, such as with bottlenose dolphin and sea turtles. Hundreds of billions of larval menhaden (and relatives) were likely killed as a result of the DWH oil spill (PDARP 2017). This project seeks to produce ecosystem benefits via a short-term, voluntary, company-specific quota program for a specified period. Proposed is "purchase" of the fleet's future expected annual landings beyond 300,000 metric tons for a 5-yr period, which would represent about a 33% decrease in pre-oil spill (i.e., 2005-2009) landings. This initial offer would total $75M for: (1) the two menhaden reduction companies to hold themselves to a 5-yr voluntary total allowable catch (TAC) of 300,000 metric tons; and (2) development and implementation of a multi-species/fishery monitoring and assessment program with which to quantify impacts. Compensation would be allocated between the two companies (Omega Protein and Daybrook) based on their 2005-2009 landings. The compensation would add significant profits to current operations, as the companies would not have operating costs for that portion of the 'landings' beyond the 300,000 mt TAC. Given the diversity of living resources and fisheries that are predicted to benefit, and the magnitude of those benefits, this action may be a viable, cost-effective and potentially transformative opportunity to implement ecosystem restoration in the Gulf of Mexico. Project benefits include (1) restoring the eco system-level prey base for multiple injured taxa, including marine mammals, sea turtles, sea birds, and fish; (2) enhancing restoration of marine mammals by ensuring sufficient availability of food resources for recovering populations (e.g., damage assessment data indicate low body-weights of Barataria Bay bottlenose dolphin after the spill); (3) reducing bycatch of sea turtles, marine mammals, and non-targeted fishes; and (4) enhancing recreational and commercial fishing opportunities by allowing other fish species and fisheries to indirectly benefit from the increased availability of forage fish that will allow for their faster growth and greater total reproduction (e.g., red drum, king mackerel, and several reef fishes). Project impacts will be quantified through analysis of data routinely collected in fishery-independent and fishery-dependent surveys conducted by state and federal scientists. The expectation is that indices of recruitment, cohort strength, reproduction and body condition of multiple taxa will increase after project implementation, as rates commensurate with each taxon's life history.		$75,000,000
	Developing a standardized monitoring plan for deep coral communities	Conducting research and restoration in deep coral communities (ranging in depth from 50-2000 m) is costly and difficult. NCCOS proposes to implement its expertise in developing pre and post restoration monitoring programs and partner with funded agencies to conduct restoration in the Gulf of Mexico. NCCOS will leverage its current activities with the RESTORE Council by developing best practices and synthesizing information from all monitoring programs in the Gulf of Mexico as well as capitalize on research being conducted for the RESTORE Science Program, which is sponsored by NCCOS.		$500,000
	Supporting Protection and Management of Deep Benthic Communities by Understanding Coral Population Connectivity	This project addresses the fundamental question: To what degree are populations of deepwater corals connected throughout the Gulf of Mexico? With continued anthropogenic threats, there is an urgent need to make decisions that will lead to the effective management and conservation of vulnerable marine ecosystems. In the Gulf of Mexico (GoM) deepwater corals play a foundational role by generating habitat for diverse and abundant invertebrate and fish communities, including refuge, foraging and breeding grounds for commercially valuable fisheries. As such, the GoM Fishery Management Council is currently designating some of these sites as Habitat Areas of Particular Concern and the Flower Garden Banks NMS has proposed an expantion to encompass additional deepwater coral sites. These management activities align well with restoration goals: The establishment and management of protected areas is one of the key restoration approaches for deep benthic communities impacted by human disturbances (PDARP, 2016). To help guide management activities, this project aims to address crucial gaps in our understanding of population connectivity patterns in habitat-forming deepwater corals in the GoM, including species directly impacted by the Deepwater Horizon oil spill. Knowledge of the factors that promote or impede the connectivity of discrete deepwater benthic communities is essential to ensure their resilience and sustainability. The most effective way to estimate connectivity patterns in deepwater populations is through population genomic approaches, which reveal patterns of dispersal in virtually any species. The project objectives are to: 1) Define spatial scales of coral population genetic structure; 2) Infer the relative rate and directionality of genetic exchange among coral populations to reveal source/sink populations. To achieve these objectives, this project would quantify population connectivity in deepwater coral species through the integration of ROV field sampling and state-of-the-art population genomic analyses. This project explicitly links basic research that would enhance the understanding of GoM ecosystems with concrete restoration and conservation initiatives to ensure recovery of degraded deepwater benthic communities. A handful of studies have investigated the patterns of gene flow among a limited number of populations of deepwater corals on the upper continental slope (350-800 m) in the northern GoM (Morrison et al. 2011, Quattrini et al. 2015, Cardona et al. 2016, Ruiz-Ramos et al. 2016). However, the degree of connectivity among populations outside of this depth range in the GoM is unknown. Herrera and Quattrini have a proposal that has been supported by the NOAA RESTORE Act to conduct a smaller-scale connectivity study focusing on 6 known populations of two deepwater coral species that occur at two depth ranges: Callogorgia delta (upper continental slope 400-1100 m) and the spill-impacted Paramuricea biscaya (lower continental slope 1300-2400 m). This will provide preliminary data on the connectivity of these species, but does not include all known sites, or sites that have yet to be discovered through other Restoration mapping and exploratory work. Under-sampling populations can generate bias in the estimates of genetic connectivity in wide-ranging species (Koen et al 2013). This project aims to significantly expand the scope of that study by studying all known and soon-to-be-discovered populations of these coral species in the GoM. This augmented effort is essential to gain a comprehensive understanding of the connectivity networks among deep benthic communities in the GoM, which will provide the information necessary to focus conservation efforts on the most important sites for maintaining existing populations of these species and contributing to the restoration of the P. biscaya populations that were impacted during the spill.		
	Exploratory cruises to locate new sites of deep-sea coral abundance	Paramuricea biscaya is a deep-sea octocoral that has a broad distribution. It was the most common species among those that showed clear impacts from the Deepwater Horizon oil spill. The first deepwater coral site to show these impacts was found in lease block Mississippi Canyon 294 in November 2010. Since then, 3 more sites were found to be impacted, with damage documented to those populations to varying degrees. During the search for these communities, other P. biscaya populations were discovered. Most of the sites in the immediate vicinity (< 25 nautical miles) of the Deepwater Horizon contained relatively small populations of P. biscaya, on the order of 100 colonies or less. A larger population was first observed in 2009 along the northern end of the Florida Escarpment, just to the south of the opening to the DeSoto Canyon, and then was further explored in subsequent cruises. One other population of 50-100 P. biscaya colonies is known from Green Canyon 852, much further to the west. In order to properly conduct direct restoration actions that would help to replenish the impacted populations and restore their ecosystem function, or conduct compensatory restoration in the form of protections for significant existing and healthy populations, a more complete assessment of the existing population structure of this species in the Gulf of Mexico is required. The sites listed above are certainly not the only places that P. biscaya exists in the Gulf of Mexico. In this proposal, we describe a plan to discover additional P. biscaya sites and to assess the size and population structure at these locations. There are two ways to predict new sites of P. biscaya populations, through predictive habitat modeling and This will help to suggest areas that fit what we know of P. biscaya's niche in the Gulf of Mexico. These models will not be followed blindly, but their quantitative assessment of habitat suitability will be used to select the most probably sites from our long list of potential sites based on more qualitative assessments of depth, hard substrata, and bathymetry that have been used over the years to discover all of the deep-sea coral sites known so far from the Gulf. Once sites are selected, two cruises will be carried out to ground-truth these locations. First, we will conduct preliminary surveys using the AUV Sentry on a cruise of approximately 30 days. Targets will be selected for high-resolution (< 50 cm scale resolution) bathymetry from the Sentry AUV obtained at a height of 20 m above the seafloor. Then, the most high-probability targets will be selected for photo surveys at a height of 5 m above the seafloor. If these specific targets within each site are fairly large, this will consist of parallel transects with closely spaced but non-overlapping lines and images. If it is a small area (< 50 m on a side), then the entire area will be photographed with overlapping photos to ensure complete coverage of the target. All of photos will be analyzed and any visible coral colonies will be scored. Corals will be identified to the lowest possible taxonomic level. Any sites with P. biscaya colonies or octocoral colonies of unresolved identification will be visited on the next cruise with an ROV. This cruise will also be approximately 30 days and will utilize an large scientific ROV with precise navigation, a 7-function manipulator, and high resolution cameras set up in stereo mode for scale. This will provide the direct ground-truth of P. biscaya presence and abundance for all of the downstream studies to be conducted. Funds are estimated for 1 cruise per year for 5 years at approximately $3M per cruise.		$15,000,000

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	Fragmentation and transplantation of deep-sea corals	This proposal describes the most direct form of restoration for deep-sea corals, fragmentation and transplantation of coral colonies. There were four impacted sites, with approximately 300 coral colonies affected by the spill. It would take a large effort to replace all of these colonies directly, and since this has never been attempted before in the deep sea, a pilot study is required to see if this method will be an effective strategy. The pilot study will be conducted to ensure that the result of this project is a net gain of coral structure rather than a loss due to smaller colony sizes and increased mortality. Initially, two different large populations will be targeted as a source of the corals. One branch will be trimmed from each of six large colonies using custom coral cutters on an ROV manipulator and transported to the surface in insulated bioboxes. Source colonies will be marked with a physical marker and will be carefully imaged before and after sampling. From previous work, we know that careful sampling of branches from P. biscaya does not harm the source colony, but we will monitor these colonies to document our impact. On the surface, the base of the fragments will be placed inside a small length of tubing and this will be mounted on a larger platform for deployment. There are two options – either onto a rack that can be easily mounted on the artificial substrates (if this restoration strategy is also selected), or onto a larger concrete block that ca still be picked up and deployed from an ROV. Three of the colonies will be returned to the site they were collected from and three will be placed at the other collection site (reciprocal transplant design). Large physical markers will be placed along with them so they are easily relocated. Transplanted colonies will be monitored using up-close imagery during annual ROV cruises to evaluate their progress. These cruises will be planned and carried out in collaboration with other Restoration projects in order to maximize the efficiency of these operations. Costs include annual ROV cruises to evaluate the progress of the corals. These could be combined with other projects and reduce the total cost.		$15,000,000
	Direct Restoration of Deep-Sea Coral Habitats with Artificial Substrates	Deep-sea corals provide a number of ecosystem services for the Gulf of Mexico and are inexorably linked to the broader Gulf ecosystem. They provide habitat for a diverse community, including shelter from predators and breeding grounds for mobile fish and squid species. They are also responsible for significant amounts of carbon sequestration and the remineralization of nutrients. These nutrients can then be upwelled into the surface waters, or transferred via interactions with diel vertical migrators, and fuel the productivity of offshore planktonic communities. Therefore, the loss of deep-sea corals can have repercussions for the entire Gulf of Mexico large marine ecosystem. There were four primary sites of impact to the deep-sea corals of the Gulf of Mexico. These are found within a radius of approximately 25 km from the Deepwater Horizon, and are dominated by the octocoral species, Paramuricea biscaya. Direct restoration of these communities would be the most rapid and effective way to replace their ecosystem function and services. Placement of appropriate substrata for the establishment of new populations in pathways of connectivity would be an effective means to achieve these restoration goals. Deep-sea octocorals rely on hard substrata with sufficient biofilms for settlement and successful metamorphosis. Hard substrata that have been colonized by deep-sea corals in the area include natural authigenic carbonates, shipwrecks, and oil drilling infrastructure. The most significant populations of P. biscaya are found on near-vertical carbonate and granite substrata. The best strategy for placement of artificial substrata would be to mimic the habitat where the most abundant known populations are present. Therefore, we propose to use structures similar to the concrete “reef balls” that have been successfully employed for coral restoration in shallow waters. These are spherical, reinforced concrete structures with holes placed in them, similar in appearance t o a large whiffle ball. These would be placed in areas near existing populations that can serve as a source of propagules for the establishment of these restored communities, and along existing corridors of connectivity, as determined by other Restoration work. The areas of seafloor selected for deployment will be surveyed prior to placement to ensure that they do not contain sensitive habitats that could be disturbed by this placement. Individual reef balls would be lowered to the seafloor on a wire and released just over the seafloor to minimize disturbance. There would be 4-5 structures placed at each site. One of these per site will be instrumented with oceanographic sensors, in collaboration with other restoration projects. These will be monitored for colonization by visitations with an ROV on an annual basis. This ship time would be best utilized by combining this study with additional work that would occur at the same sites and use similar submersible assets. In the first year of the study, only 2-3 of these would be deployed very close to a large population of P. biscaya as a pilot study. We know that colonization of metal structures takes at least 6-7 years based on surveys of oil rigs and platforms of known age, but the concrete carbonates should be colonized earlier. We can also decrease the time to colonization by incubating the structures in natural seawater in order to begin the process of biofilm growth. If coral colonization is revealed in the first 1-2 years of deployment, then this project could be scaled up to additional sites, as determined by other genetic connectivity and predictive habitat modeling studies.		$20,000,000
	Restore Gulf of Mexico Ecosystem Injuries by Protecting Open Ocean Habitat	The Deepwater Horizon oil spill was the largest man-made disaster ever and will have long-lasting impacts on the Gulf of Mexico ecosystem, including marine mammals, sea turtles, and pelagic and benthic fish and invertebrates. Large-scale ecosystem impacts require large-scale restoration efforts. The most effective method for improving damaged ecosystems is by setting aside and protecting habitat from anthropogenic impacts. This restoration idea is to set aside large (thousands of square kilometer) regions in the Gulf of Mexico to protect and enhance recovery of all impacted taxa by protecting the ecosystem from all anthropogenic activities, for example by creating marine protected areas or similar habitat protections. Priority habitats to protect might include the only known Bryde's whale habitat of the northeastern Gulf of Mexico, the productive foraging habitat of sperm whales near the Mississippi Canyon, the potential calving habitat of sperm whales off the Dry Tortugas, expanding the area of the reef ecosystem habitat protections of the Flower Garden Banks sanctuary, or creating similar habitat protections for deep coral reefs throughout the northern Gulf of Mexico. Ecosystem damage at never-before-seen spatial scales requires ecosystem protection at similarly large scales and must be included as part of the restoration projects to encourage ecosystem recovery.		$10,000,000
	Temporal dynamics of eukaryotic plankton diversity at northern GOM deep benthic coral communities	The Deepwater Horizon oil spill in 2010 caused injury to the entire ecosystem in the northern Gulf of Mexico. Despite playing important ecological roles, the small (less than 2 mm), cryptic eukaryotic species that make up the plankton remain a poorly documented component of marine ecosystems (Leray & Knowlton 2016), especially in the deep Gulf of Mexico (GOM). Long-term time-series datasets have shown that plankton are sensitive indicators of environmental change, often having a non-linear response that can amplify otherwise subtle environmental disturbances (Hays et al., 2005). As such, establishment of biological baselines are necessary in order to quantify changes in biodiversity over time and to predict the impacts community shifts may have on sensitive deep benthic communities. In the last decade, metabarcoding and high-throughput sequencing (HTS) have radically improved our understanding of microscopic eukaryotic diversity, including unicellular and small multicellular species- groups that have been challenging for taxonomists due to lack of diagnostic features and an inability to be cultured. Importantly, such approaches have been used to document environmental impacts to shallow-water benthic microbial eukaryote communities following the Deepwater Horizon oil spill (Bik et al., 2012). We propose to sample benthic planktonic communities monthly using instrumented moorings or benthic landers, and use metabarcoding techniques and high throughput sequencing (HTS) to characterize biodiversity, to assess deep sea coral larval supply, and to identify key planktonic contributors to carbon export from surface waters that sustain sensitive benthic communities. Environmental DNA will be screened for target select GOM eukaryotic plankton (e.g. protists, foraminiferans, zooplankton, coral larvae, fishes), using taxon-selective amplicon libraries and HTS sequencing (Illumina) following molecular methods utilized in the TaraOceans project (DeVargas et al., 2015 and/or T homsen et al., 2012). Amplicon libraries will also be created for several mitochondrial genes that are likely to provide increased taxonomic resolution for mesozooplankton, Comparable sequence data will be generated for taxa known from these habitats from previously collected vouchered specimens, creating barcode libraries that will allow for comparisons to the marine barcode of life database (MarBOL; http://www.marinebarcoding.org/) and will be made publically available. Seasonal water sampling using an ROV or AUV at deep coral habitats will complement the temporal benthic eDNA sampling, allowing for freshly preserved samples for both visual species identifications and metabarcoding. Additionally, repeated plankton tows or sampling with an AUV water filtering device will target certain water column depths (e.g. surface, and below thermocline and nutricline) that will be determined by water column temperature profiles using a CTD. The cost of this research could be reduced considerably (by upwards of $4,000,000) by sharing ship and ROV/AUV time with complementary studies of deep coral habitats, such as assays of coral microbiomes and health, hydrodynamics, nutrient dynamics, and restoration.		$5,121,868

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Restoring the offshore, open ocean seagrass beds of the Chandeleur Islands	Seagrasses are variably and sometimes negatively affected by exposure to oil, likely depending on the duration and directness of the exposure (Fonseca et al. 2017). During the DWH event, the offshore seagrass beds of the Chandeleur Islands were subjected to extensive and direct oiling that resulted in over 100 acres of probable seagrass loss (Kenworthy et al. 2017). Those losses, coupled with ongoing instability of the Chandeleur Islands (Handley et al. 2007) and attempts at stabilization (http://www.mississippiriverdelta.org/files/2015/11/Chandeleur-Isl-Post-berm-Rpt-UNO_Apr_27_2015v3_withApendix-FINAL.pdf), albeit short-lived, provide an opportunity to test new technology that has been developed and applied for the creation of seagrass habitat in wave-dominated environments in order to provide longer-lasting resource stability. Here, we propose to install specially engineered, free-standing wave attenuation devices designed for high wave environments and maintaining vertical position (i.e., not dependent on supporting seafloor) to provide a lasting nucleus of physical stability, especially on southern on portions of the Chandeleur Island chain where oiling impacts to seagrasses occurred. Using previous and ongoing assessments of both island stability (e.g., Thomson et al. 2010) and seagrass dynamics and open ocean wave modeling, we will emulate an approach utilized in North Carolina where we placed a large break in a dynamic and patchy seagrass environment to create wave attenuation and foster seagrass bed coalescence and stability, sand accretion, and marsh and beach formation. By combining this novel technology with the strong foundation of information regarding the status and dynamics of the Chandeleur Island chain, we will select appropriate, replicate areas for application of the permanent shoreline stabilization structure and design appropriate assessment and monitoring to report on performance, generating dozens of acres of new seagrass habitat. Thro ugh careful surveys and application of regional restoration knowledge, final site selection will seek to enhance a variety of habitat types that also confer physical stability, such as mangrove and marshes to act in concert with the seagrasses and wave attenuation structures. Creation of new, stable seagrass acreage in this most oceanic of seagrass beds in the Gulf of Mexico will support a wide variety of wildlife, including foraging seabirds, fishes and invertebrates, many of which are economically prized both recreationally and commercially in the Chandeleur Island chain. References: Fonseca, M.S., Piniak, G. and Cosentino-Manning, N. 2017. Effect of the Cosco Busan oil spill on the ecology of eelgrass, Zostera marina in San Francisco Bay. Marine Pollution Bulletin. http://www.sciencedirect.com/science/article/pii/S0025326X1630950X Handley, L., Altsman, D., and DeMay, R., eds., 2007, Seagrass Status and Trends in the Northern Gulf of Mexico: 1940–2002: U.S. Geological Survey Scientific Investigations Report 2006–5287, 267 p. This reference includes a section on the Chandeleurs Kenworthy WJ, Cosentino-Manning N, Handley L, Wild M, Rouhani S (2016) Seagrass response following exposure to Deepwater Horizon oil in the Chandeleur Islands, Louisiana (USA). Mar Ecol Prog Ser. https://doi.org/10.3354/meps11983 Thomson, G., Miner, M., Wycklendt, A., Rees, M. Swigler, D., 2010. MRGO Ecosystem Restoration Feasibility Study – Chandeleur and Breton Islands. Boca Raton, Florida: Coastal Planning & Engineering, Inc. 96p. (Report prepared for USACE under contract to URS)	Plaquemines, Saint Bernard	$3,500,000
	Adaptive management for sustainable fisheries and ecosystem restoration in the Gulf of Mexico.	Conventional single-species stock assessments determine if a fish stock is experiencing excessive fishing mortality (known as overfishing), if the stock has been reduced to low abundance (known as overfished), and forecast a sustainable fishing mortality rate. A sustainable harvest policy is prescribed by combining this rate with a forecast of fish abundance. However, projections from single-species assessments may not adequately capture uncertainty when, for instance, targeted species are co-caught by fishing gear and interact strongly, as in a reef fish assemblage. These shortcomings may be significant impediments to effective management of depleted and recovering stocks. In order to improve management decisions targeting long-term sustainability of ecosystems and fisheries in the Gulf of Mexico, we propose to develop decision support tools that are rooted in decision theory: structured decision making (SDM) and adaptive resource management (ARM) in particular. SDM (note that ARM is a special case of SDM for dynamic decisions, with scientific uncertainty) includes at least five components: management objectives, potential management actions, model of system behavior (which project consequences of management actions on the system), a monitoring program to monitor the system state and finally an optimization method to identify decision that are optimal relative to the management objectives (e.g., Martin et al. 2011). We propose a SDM/ARM framework to assist managers with identification of optimal harvest policies that balance competing management objectives (socio-economic, ecological sustainability and impact on ecosystems). We will consider multiple fish populations; specifically we intend to focus on the grouper-snapper complex. The SDM tools will be developed as extensions to stock synthesis models (Methot and Wetzel 2013), thereby integrating the SDM tools with the stock assessment and inheriting the same data uncertainties and population dynamics. We will also leverage existing Gulf of Mexico ecosystem models to project consequences of potential management actions on the system, including both Atlantis (Ainsworth et al. 2015) and Ecopath with Ecosim (Chagaris et al. 2015) models. We will additionally evaluate the performance of our decision support tool in a simulation environment using management strategy evaluation (MSE). This process will also inform data collection programs and may help end users (i.e., natural resource managers from FWC and NOAA) prioritize research to fill critical data gaps and characterize the key sources of error associated with monitoring. Specifically we would discuss how to reduce errors associated with imperfect detection and spatial autocorrelation. Our approach will require a multi-disciplinary effort to engage stakeholders, and will require elicitation of socio-economic values associated with the consequences of potential management actions. Therefore, we propose to include a human dimension component to our project. We would apply concepts of behavioral economics to gain insights into stakeholders' behavior and to help improve the effectiveness of outreach programs. This could in turn increase voluntary fisheries-related actions to increase fish biomass. Additionally, Co-PI Dr. Luiz Barbieri will serve as the primary interface with the Gulf of Mexico Fishery Management Council, ensuring this research is aligned with the current needs of the council. This research meets the criteria for being appropriate under the Oil Pollution Act of 1990 (OPA) as it is intended to help return injured natural resources and services to baseline by supporting the development of methods which will result in increasing biomass of injured fish species (Deepwater Horizon NRDA Trustees 2016). This research will explicitly aim to reduce overfishing and bycatch of reef fishes while simultaneously achieving higher catches in the medium and long term compared to the status quo.		$1,800,000
	Gulf of Mexico Open Ocean Trophic Ecology Program	The objective of this project is to examine in detail the trophic connections of fishes, cephalopods, and crustaceans (nekton, collectively) inhabiting the epi-, meso-, and bathypelagic regions of the GoM using stable isotope, fatty acid and metabarcoding analyses. The specific goal of this study is to use natural dietary tracers and metabarcoding analysis to examine the trophic ecology of meso- and bathypelagic nekton and to elucidate vertical food web structure (0 to 1500 m depth) patterns in order to quantify trophic connectivity in the northern GoM. Stable isotope, fatty acid, and metabarcoding analyses have been used successfully to examine food web structure in many systems. In this study samples collected during previous sampling efforts (NRDA Offshore Sampling and Analysis Program and DEEPEND, www.deependconsortium.org) as well as proposed sampling efforts (please see Gulf of Mexico Deep Water Column Monitoring Program project suggestion) will be analyzed for stable isotopes of carbon (δ13C) and nitrogen (δ15N) to evaluate food web structure, examine flow of organic matter and determine trophic relationships of target organisms collected in the GoM. Analysis of polyunsaturated fatty acids (PUFA) will serve as indicators of dietary sources, allow for the reconstruction of dietary histories, and provide additional data that may not have been elucidated through previous stomach content or stable isotope analyses. Because gut contents of many deep-sea taxa are difficult to due to mastication, metabarcoding, which allows for the identification of prey taxa by extracting species-specific DNA sequences, will be used to identify stomach contents of deep-sea crustaceans and cephalopods. Additionally, we propose to incorporate tissue analyses from upper level predators (large fishes, sharks, mammals) already collected in the GoM from colleagues over a similar spatial and temporal period. Bayesian mixing models (e.g., mixSIAR) designed for stable isotope and fatt y acid data will be used to estimate prey contributions to predators. All trophic analyses will be focused on key "model species" which will include both vertically migratory and non-migratory fish and invertebrate species with multiple feeding strategies. By examining stable isotopes, fatty acids, and gut contents of migrating and non-migrating fauna this project will shed light on the nature of energy and carbon transfer across vertical ocean zones and describe trophic connectivity in the region of the GoM where the DWHOS occurred. Results of this study will provide important information on the role of different migratory and non-migratory prey types to predators in the GoM allowing researchers to identify species or taxonomic groups that may serve as "vectors" between functional groups or to commercially valuable fisheries stocks, sea birds, and protected oceanic cetaceans, all of which rely on deep-pelagic nekton as prey. The detailed elucidation of feeding dynamics within the major taxa of nekton will allow for multidisciplinary studies based on the larger-scale distribution of biomass. Finally, by describing vertical and horizontal patterns in the trophic structure of deep-pelagic nekton this project will provide baseline trophic data that can be used to inform spatially explicit ecosystem models that will provide insight into the structure and functioning of the northern GoM pelagic ecosystem.		$475,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Genetic and chemical indicators of population health, recovery, and resilience in the Gulf of Mexico	The primary goal of this project idea is to continue monitoring population health of water column fish and invertebrate communities from the open ocean (0-1500 m) on both short (generational) and long (evolutionary) timescales, using genetic and analytical chemical methods. This information is critical for understanding the recovery, resilience and long-term consequences of the DWHOS on key deep-pelagic species. Genetic diversity is often used as a proxy to measure population health. This measurement is intimately tied to an organism's ability to survive and adapt to a changing environment. Genetic diversity can be reduced by rapid declines in population sizes following a major disturbance event. Low genetic diversity has severe consequences within a population, such as increased extinction risks and reduced recovery rates. A second metric often used to infer population, and ultimately ecosystem, health is "population connectivity," or the amount of genetic information shared and/or exchanged between populations. For this reason, determining how genetic diversity is shared and exchanged within and across the GoM has huge implications for the recovery and resilience of a species and the ecosystem. Alongside estimates of genetic diversity and connectivity, chemical analyses of deep-pelagic fauna can be measured to assess the persistence of oil-derived hydrocarbons in the environment and their potential impacts on the community. Within crude oil mixtures, PAHs (polycyclic aromatic hydrocarbons) are highly soluble in water and are relatively easily taken up by oil-exposed biota. PAHs in the water can cause lethal and sublethal effects (e.g. endocrine disruption, growth inhibition, genetic damage) to marine organisms via ingestion and/or absorption through the skin. We propose conducting a robust ten-year time series analysis that characterizes changes in genetic diversity, connectivity, and PAH exposure in deep-pelagic GoM communities. Over the past 7 years we have co llected and analyzed samples of invertebrate and fish from before DWHOS, immediately following the spill (ONSAP cruises 2010-11), and 5-7 years post-spill (DEEPEND cruises 2015-17). To date, we have found several intriguing results: 1) a general increase in crustacean genetic diversity from 2011-16, suggesting possible species' recovery following the DWHOS 2) GoM populations have unique genetic diversity, suggesting possible "oil" resistance 3) genetic connectivity may be linked to life history, suggesting recovery and resilience potential may be predictable 4) elevated PAHs in deep-sea fishes following the DWHOS suggesting higher intake rates compared to clearance rates 5) a recovery to baseline levels in 2015-2016 in only some biota groups (octopus) 6) continued high PAH levels in eggs, potentially affecting the long-term stability of the deep-pelagic community. We propose a continued 3-year program that builds upon our genetic and PAH datasets collected over the past seven years. First, we will continue to monitor genetic diversity and PAHs across select crustacean and fish taxa, as a measure of population health. We will use established methods implemented during the DEEPEND project, but also integrate new applications that will test for genomic signatures of population reduction or expansion and persistence of hydrocarbons in the pelagic biota. Recovery and resilience will be measured by estimating genetic connectivity within and across the GoM, capitalizing on previous and future sampling expeditions. A key element of the proposed project is tight linkage with NOAA to help inform restoration planning, implementation and evaluation. We suggest integrating the genetic diversity estimates into population/ecosystem modeling approaches, which has rarely been used in these applications. The restoration topics with which the suggested project align include Water Column Fish and Invertebrates, and Mesophotic and Deep Reef Communities.		$2,400,000
	Gulf of Mexico Deep Water Column Monitoring Program	The Deepwater Horizon Oil Spill (DWHOS) highlighted the lack of baseline data for deep-ocean ecosystems in the Gulf of Mexico (GoM). Of the GoM open ocean habitats, the deep water column is by far the largest affected by the DWHOS. Long-term monitoring of the diversity and abundance of the pelagic fauna (0-1500 m) of the open GoM, including oceanic fish larvae and the microbial flora, is essential for evaluating impacts of natural and anthropogenic events. We propose multi-year expansion of knowledge as a restoration tool. "Research as restoration" is an approach with precedence, enacted after the Exxon Valdez oil spill and pursued subsequent to the DWHOS event. A 3-year (to start) sampling and analysis project that follows the methods developed during an intensive NOAA NRDA program in 2010-11 (ONSAP) and continued during 2015-2017 (DEEPEND Consortium) is envisioned. Analyses of these time series have revealed that the abundance of pelagic fishes decreased nearly an order of magnitude between 2011 and 2016. This substantial change was not obvious shortly after the spill and supports the importance of a long-term approach. Time-series investigations are known to be critical for assessment of ecosystem variability and recovery. We propose an integrated program that includes discrete-depth sampling and water collections simultaneously with acoustical sensing. With respect to surveys of economically important fishes (e.g., billfishes, tunas, dolphinfishes, swordfish), continuation of a long-term epipelagic survey of ichthyoplankton conducted during the primary spawning periods of many taxa is essential. Epipelagic and deep pelagic surveys can be merged logistically and provide insight on the vertical coupling of pelagic communities found from the surface to >1000 m. Remote sensing information and physical modeling will be used to direct the locations of at-sea sampling. We suggest that identical sampling procedures and gear used in prior surveys be adopted for future monitoring to eliminate methodological bias. In addition, a focus will be given on the continental shelf break/slope of the GoM, a region of enhanced benthopelagic coupling (e.g., sonic scattering layers intersecting benthic habitats) as well as primary foraging grounds for marine mammals and seabirds. It is also the transition area for material exchange between oceanic to continental shelf domains. The rationale for the project stems from the recent discovery that that over half of all fish species in the GoM spend all or part of their lives in the open ocean. In terms of total GoM fish abundance, deep-pelagic fishes are the most numerous. Endangered toothed whales, seabirds, and epipelagic game fishes rely on deep-pelagic fishes, squids, and shrimps as prey. Further, the transfer of energy through open ocean food webs is higher than typically assumed, suggesting a much greater role for of deep-pelagic animals in oceanic ecosystems. In short, the deep-sea animals are a key component of the GoM open ocean ecosystem. A key element of the proposed project is tight linkage with NOAA to help inform restoration planning, implementation and evaluation. We suggest using ecosystem modeling approaches to achieve this result. The project suggested here has been endorsed by the principals at NOAA who supported the initial NRDA surveys and utilized these data in the NRDA. This restoration project aligns with Water Column Fish and Invertebrates, Mesophotic and Deep Reef Communities, Marine Mammals, Birds, and Monitoring and Adaptive Management.		$6,900,000
	Regional & Open Ocean Research to Reduce HMS Mortality & Advance Recovery	The Billfish Foundation (TBF) is a science-based, non-profit, charitable (501) (c) (3) organization, based in Ft. Lauderdale, Florida with constituents around the world, including a strong base in Gulf of Mexico states. TBF's priorities include research, education and advocacy for responsible use and conservation of billfish (marlin, sailfish, spearfish). TBF proposes to use dart tags, a cost-effective tool deployed by volunteer anglers and captains, as a tool for conservation, education and research to increase release of billfish & bluefin. An increase in releases means a reduction in mortality, improvement in data collection that contributes to improving stock assessments of Atlantic marlin, sailfish and North Atlantic bluefin tuna. Increasing crucial tag and recapture data in the Gulf of Mexico and the Caribbean Sea will improve stock assessments upon which management and conservation decisions depend. Improved stock assessment analyses will support improved management needed to recover overfished stocks. The Gulf of Mexico and Caribbean Sea regions are recommended because the movements of the species from and into the tropical North Atlantic waters include ingress and egress of both regional waters. Tagging in the Caribbean Sea should result in higher recapture rates in the Gulf and those deployed in the Gulf should lead to more recaptures along the east coast and possibly in the central and eastern Atlantic Ocean. With the drop in tagging reports, due, in large part, to volunteers not wanting to pay for tags, tag sticks and applicators, a vigorous outreach and education campaign is essential to generate participation needed to gain the best data return on a grant investment. Several tools are recommended, including a 3 minute video for social media, an informative card for wide distribution that includes text that explains why an increase in tagging data is needed, a call for volunteers and how tagging data will be used. The text will also clearly state that free tags are available for distribution through TBF thanks to a grant from the Gulf Spill Restoration Fund. The goals and parameters of the project, the geographic regions in which tags are to be deployed, how to obtain free tags, how data can be submitted and how to receive subsequent tag allotments all will be included on the card. If awarded 6 year grant, TBF proposes to distribute 35,000 free tags in packs of 5. The first year's distribution goal is 10,000 tags, followed by 5,000 during each subsequent year. The majority of the tags will be distributed in the Gulf of Mexico where an abundance of volunteers are available. In the Caribbean Sea our initial distribution goal will be 1,000 tags initially in the Caribbean Sea. In subsequent years, our goal will be to increase the tag distribution in each of the two regions. If a vessel has a strong tag reporting history with TBF, 15 tags will be allocated the first year. Subsequent year distribution will be based on reporting of tag data for 3 of any combination of blue marlin, white marlin, sailfish and/or bluefin tuna from the previous year's allotment. If any tags remain undistributed at the end of the research period, distribution in the same manner will continue. A 6 year research period provides ample time over which recaptures should be made and reported. The time frame also provides scientists the opportunity to compare numbers of recaptures to recaptures during previous time frames, and the time needed to compare current/last year's or next year's stock assessment results with subsequently scheduled assessments. With bluefin tuna, the time frame for comparing might be best to wait until the 2023 assessment for assessment are more frequent than for billfish. ICCAT Stock Assessment Schedules Blue Marlin White Marlin Sailfish Bluefin Tuna 2018 2018 2016 2017 + 6 yrs - 2024 + 6 yrs – 2024 +9 yrs - 2025 + 3 yrs – 2020 & 2023	N/A	$447,480

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Assessment of anthropogenic stressors in holopelagic Sargassum nursery and foraging areas in support of multispecies restoration objectives	Background: Sargassum is a critical but understudied habitat in open ocean waters of the Western Central Atlantic (including the Gulf of Mexico, Caribbean and South Atlantic Bight) that provides refuge and food resources for a large animal community, including over 145 species of invertebrates, 100 species of fish, and 4 species of sea turtles. Sargassum is thought to be a nursery area for the juvenile stages of many fish species (e.g., Mahi Mahi, Gray Triggerfish) and sea turtles. It is also a foraging ground for the adult stages of these same fishes and turtles, as well as many species of sea birds, including Sargassum "specialists" like Audubon's Shearwater, Royal Tern, and Bridled Tern. For these reasons, Sargassum has been designated as Essential Fish Habitat in the South Atlantic, but currently it does not have the same status in the Gulf of Mexico. Assessment Needs: There are many stressors that potentially impact Sargassum communities as a result of human activities, including restoration actions. Oceanographic processes aggregate Sargassum with other floating material. This was evident during the Deepwater Horizon oil spill, when large mats of Sargassum and associated animals were oiled. A more pervasive and ongoing problem is marine debris (including microplastics) and the associated toxins that accumulate in Sargassum. Several studies have examined the consumption of plastics by sea birds, fishes, and sea turtles, therefore an understanding of the impacts of marine debris within Sargassum foraging areas is critical. Further, predicted increases in atmospheric carbon dioxide may increase Sargassum growth, yet the subsequent increases in ocean acidification may have negative effects on organisms. Little is known about the impacts of these multiple stressors acting in concert within marine environments. And, numerous large-scale restoration projects have been proposed in the northern Gulf of Mexico, many of which may alter physical processes in neritic wat ers (e.g., nutrient inputs), which in turn may affect Sargassum habitat quality, growth and distribution. Objectives: Using field surveys, remote sensing, and both in situ and mesocosm experiments, our objectives are to quantify: 1) natural and anthropogenic factors that control Sargassum growth and 'bloom' dynamics in the Western Central Atlantic; 2) the impacts of increased atmospheric carbon dioxide and resulting ocean acidification on the growth and condition of Sargassum and associated fauna; and 3) the impacts of marine debris and associated toxins on Sargassum and associated fauna. Relevance: This work spans multiple Restoration Priorities: Birds, Sea Turtles, and Fish and Water Column Invertebrates. The National Academy of Sciences notes that "to be effective, restoration plans need to account for variation in ecosystem processes, resources, and stressors that are likely to affect restoration objectives for the target species or habitats. Inadequate understanding of the impacts of such environmental variation leads to uncertainties in the planning of projects and to unfavorable outcomes". Here we propose a program designed to better understand the role of Sargassum in the marine environment, and how Sargassum communities will respond to anthropogenic perturbations and restoration/management actions. Benefits: We will "address relevant data gaps" for Birds, Sea Turtles, and Fishes. Our work will provide data relevant to the "restore and conserve bird nesting and foraging habitat" priority. For Sea Turtles, we will address the "primary threats in marine and terrestrial environments" priority. And for Fishes we will fill "information needs" for "reef fish, highly migratory species, ... and coastal migratory species." The work proposed here will build on previous and current works, and leverage existing surveys to examine multiple stressors on pelagic Sargassum and associated fauna, and the implications for effective restoration efforts.		$6,500,000
	Restoration of Gulf of Mexico Fisheries Through Enhanced Monitoring and Assessment	The overarching restoration outcome this project aims to facilitate is the replenishment and protection of Gulf of Mexico fisheries through improved data collection, stock assessment, and management. While a multitude of fish and invertebrate populations were likely affected by the spill, only a handful can be restored through direct actions to reduce fishing and bycatch mortality. We suggest that a more comprehensive approach is required to facilitate ecosystem-scale recovery. Accordingly, this project involves a dramatic increase in the quantity and quality of fisheries-independent data for managed fish and invertebrate populations, their potential prey, habitat quality and abundance, and physicochemical oceanographic parameters throughout the eastern Gulf of Mexico. Although focused on Florida waters we will coordinate sampling activities with the other Gulf states as well as NOAA Fisheries. Existing surveys will be expanded spatially, sampling intensity will be increased, and survey design and sampling methods will be standardized among partners. In the short term, this project will increase the accuracy and reduce the variability of estimates of key population parameters that are critical for single-species stock assessment, including age-specific relative abundance, size/age composition, size/age at maturity, spawning stock biomass, size/age at transition, sex ratio, and fecundity. This project also proposes to continue the significant and meaningful expansion of the collection of fisheries-dependent data in the northern and eastern GOM that was initiated following the Deepwater Horizon oil spill. Fishery dependent data are necessary to continue to assess the recovery of offshore recreational and commercial fisheries in association with restoration efforts, improve and expand single-species stock assessments for managed fishes, and improve timeliness and precision of data used to sustainably manage recreational fisheries with Annual Catch Limits. The ob jectives are to build upon and enhance existing fisheries dependent monitoring programs in Florida, in collaboration with federal and regional partners, that are compatible with fishery-independent sampling efforts in the region and that foster improved ecosystem-based assessment and management capabilities, and develop a long-term time-series from integrated surveys that fully address monitoring and stock assessment data needs specific to offshore fisheries. Data from this project will contribute to increased accuracy and reduced uncertainty in stock assessments of species managed by the Gulf of Mexico Fishery Management Council.		$15,000,000
	Gulf of Mexico Pelagic Ecosystem Technical Advisory Group	We propose to create a technical group focusing on the Gulf of Mexico pelagic Ecosystem. The new technical group will be charged with the development of a draft ecosystem management plan to restore, enhance and manage shared (between US, Mexico and Cuba) pelagic resources within the Gulf of Mexico Ecosystem . The group will provide the management plan as an input to the technical advisory processes of the International Commission for the Conservation of Atlantic Tunas, the Convention on the Conservation of Migratory Species of Wild Animals, Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles, the International Whaling Commission and the US Gulf of Mexico EIA process. The technical group will focus on the use of advanced population modelling and simulation to asses the effectiveness of current management measures aimed at restoring highly migratory resources in the Gulf of Mexico and will work closely with the different international conventions to define which management strategies are currently in used and which alternative strategies may be proposed. The group will also evaluate the active restoration projects funded by the Gulf restoration projects.		$2,000,000
	Restoration of Mesophotic and Deep Sea Reefs using novel method, and maximum cost efficiency	Deep sea and mesophotic reefs were negatively impacted by the DWH spill. Restoring populations of corals, and other important fish habitat structure-forming benthic fauna is a massive undertaking, given the geographic area to be restored in the deep sea. Reef restoration using coral transplants, artificial structures, or both has been attempted in tropical (shallow) reefs with limited success. Coral restoration in the deep sea, or mesophotic zones presents even greater challenges, and potential costs, because of the inaccessibility and equipment required to work in the 50-1,000 meter seafloor. In order to overcome these challenges, and maximize the potential impact of of restoration costs, new technologies need to be developed and implemented, from site selection and transplanting, to logistics, and monitoring. Coramyd is a patent pending technology that integrates artificial reef structures, which are non-toxic, and can replace hundreds, or even thousands of corals within a week of ship time. The artificial reef structures used in Coramyd are not prone to corrosion, and can provide means of deploying coral transplants efficiently and successfully in large numbers. Structures are resistant to currents, and are less likely to snag fishing gear than other artificial reef structures. Structures are seeded with coral transplants, and are lowered to the seafloor using a small crane. Project scope is limited to restoration of populations of corals which were impacted by DWH spill over areas with specially sensitive and valuable fish populations. Please contact for more details and methods.		$579,600

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	Mesophotic reef habitat enhancement.	The 2010 Deepwater Horizon (DWH) oil spill in the Gulf of Mexico (GOM) is one of the largest industrial accidents ever to occur in US waters. Extensive decontamination activities, fisheries closures, mobilization of environmental assessment resources, and restoration efforts also make this one of the most costly accidents in US history. The DWH oil spill impacted key deep-reef fish "sentinel" species, roughtongue bass, Pronotogrammus martinicensis, and tattler, Serranus phoebe, but almost nothing is known about possible long term effects and possible recovery. In addition there are several other important commercially and recreationally valuable species that were also affected (red snapper, vermilion snapper, greater amberjack, gag, and scamp) that reside on these deep water mesophotic reefs that are close (50 to 100 km) to the DWH spill site. The primary objectives of this project will be to enhance and restore deep water reef fishes by substantially increasing reef habitat through a large artificial reef deployment program, and provide a robust assessment of the effectiveness of this habitat enhancement effort. One of the most promising approaches to mitigate the reduction in reef fishes caused by the DWH oil spill event is to increase habitat for ecologically and commercially important reef fish species through an extensive and effective artificial reef program. Such habitat enhancement may also increase the resilience of these valuable resources to future disturbances. On the MS-AL continental shelf there has been an extensive artificial reef enhancement program that has been tremendously successful, but there have been few attempts at such enhancements of deeper water mesophotic reef habitats. This project will make a restore effort of such mesophotic reef habitats by adding an unprecedented number (504) of large-sized, long-lasting artificial reefs ("super-reefs" = 25 ft. tall pyramid reefs) to the Pinnacles reef zone in the northeast Gulf of Mexico adjacent to the DWH spill site. Artificial reef placement, particularly distance between reefs can have profound influence on the effectiveness of any given artificial reef program. Therefore the habitat enhancement of this project will be tightly coupled with quantification of the effects of reef spacing on a number of critical metrics including natural and fishing related mortality, condition, growth, abundance, biomass, production, diet, and movement of several important reef fish species (e.g., roughtongue bass, tattler, red snapper, vermilion snapper, greater amberjack, gag, and scamp) as well as community characteristics such as species richness, evenness, and diversity. This will be accomplished through application of a wide array of proven methods, each of which have been developed and optimized for this system by the Auburn University Marine Fish Lab over the last 26 years. Methods include standardized hook-and-line and trap sampling, ROV surveys, hydroacoustic surveys, fine-scale passive acoustic tracking, stomach content analysis with DNA barcoding, otolith aging techniques, genomic studies, parasitology and microbiology studies. These methods will provide a comprehensive combination of data on population and community characteristics, individual condition and growth, individual movement, and resource use, and will allow an unprecedented assessment of the effectiveness of the artificial reef deployment at different levels of reef spacing. Most importantly, this project will provide stable reef habitat for increased production of important mesophotic reef fish species. We will use a combination of field and laboratory studies to examine spatial and temporal patterns in population level (age, growth, sex ratio, and genetic population structure), individual level (toxicopathic lesions and pathogens), and molecular level (genomic expression) impacts along a gradient of exposure to polycyclic aromatic hydrocarbons (PAH).		$3,260,000
	Minimizing Effect of Human Sources of Sound on Gulf of Mexico Marine Mammals	Excess sound levels have the potential to prevent the recovery and restoration of marine mammal populations that have been reduced as a result of the Deepwater Horizon oil spill, particularly sperm whales, Bryde's whales, and bottlenose dolphins. Measures have been identified for mitigating the effects of anthropogenic sources of sound from coastal construction (pile driving), oil and gas exploration and decommissioning (seismic airguns and explosives for platform removals), and military training activities (sonar and explosives), but the effectiveness of those measures has not been fully tested and verified. Research and testing is needed to develop effective and reliable mitigation measures for activities that are particularly harmful or for which no measures currently exist. Mitigation should be tested for the different species and operating conditions that occur in the Gulf. Measures could include, but are not limited to, ship quieting technologies, bubble curtains and double piles (for pile driving), marine vibroseis (as an alternative to seismic airguns), and non-explosive decommissioning options (for platform removals). Also needed are effective and reliable acoustic aids (such as passive acoustic monitoring) for use in detection of marine mammals in low light or nighttime conditions.		
	Research to Determine Gulf of Mexico Soundscape and Effects of Sound on Marine Mammals	The Gulf is one of the most heavily industrialized bodies of water in the world, with numerous sound-producing human activities, including commercial shipping, oil and gas development (including seismic studies), platform removals (including the use of explosives), coastal construction (including pile driving), and military operations and training. Excessive sound can cause disruption of important marine mammal behaviors, and—at close range—physiological injury. Excessive sound can also mask biologically important sounds, including communication calls between individuals of the same species. Research is needed to determine: • The Gulf of Mexico "soundscape" - sources of sound in the Gulf and associated sound levels and how they vary spatially and temporally. • The effects of bathymetry, temperature, and other oceanographic features on sound propagation. • The direct, indirect, and cumulative effects of human-caused sound on marine mammals and their prey species.		
	Establishment of a Gulf Sperm Whale (pelagic ecosystem) Nation Marine Sanctuary, Sperm Whale and Pelagic Ecosystem Interpretive Center, Gulf Sperm Whale and Pelagic Ecosystem Research vessel	A.Establishment of a Gulf Sperm Whale/Pelagic Ecosystem National Marine Sanctuary of significant size This sanctuary will serve as a truly pelagic sanctuary for the remaining estimated 700 resident sperm whales in the Gulf of Mexico, providing safe haven for the Gulf's largest and most endangered marine mammal species, which is the most dependent on the full spectrum of depths and habitats in the offshore water column. Sperm whales rest at the surface, dive to and feed in depths over one mile, and are most frequently found associated with the interface between cold-core and warm-core eddies along the 1,000m isobath. B. The creation of the Sperm Whale and Pelagic Ecosystem Interpretive Center on-shore A specialized, high tech facility provided for the interpretation to the public of sperm whale life histories and population dynamics, and of the pelagic environment generally, creates the capacity to educate the American public about the complex pelagic environment that very few people are ever able to directly witness. The offshore Gulf has fueled the economy through fisheries (tuna to anchovies), shipping, and oil and gas. People need to understand why, as well as what animals live there and how humans impact them. The depths of the Gulf are generally unknown to the public. The lives of sperms whales are extreme by any measure of comparison to other animals on earth and in the ocean. C. Design, development, and commissioning of the Gulf Sperm Whale and Pelagic Ecosystem research vessel, an offshore vessel dedicated to studying marine mammal population growth in the pelagic environment. The study of the pelagic environment takes specialized talents and technologies, and is truly multidisciplinary. With the establishment of the Gulf Sperm Whale National Marine Sanctuary there must be a mechanism for the natural resource managers, researchers, and others to access the sanctuary and the pelagic environment of the northern Gulf. It will be necessary to invest su bstantial time in assessing the growth or decline of populations, health of the marine mammals (fecundity and mortality and dispersion), and learn further about the life histories of the sperm whales and other marine mammals in the Gulf. D. Review of the proposed monetary allocation by the NRDA of $144 million for the restoration of marine mammals. This allocation should be adjusted by adding an allocation of $70 million for the sole purpose of establishing and managing the Gulf Sperm Whale National Marine Sanctuary, and adding a $100 million endowment dedicated to sustained research, restoration, and adaptive management in the Gulf Sperm Whale National Marine Sanctuary, lasting at least the life time of an average sperm whale, bringing the total to $314 million in funds to restore the marine mammals of the northern Gulf.	All	$70,000,000

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	Comprehensive stewardship of breeding waterbirds across barrier and nearshore islands in the Gulf (Alabama – Texas)	Waterbirds were disproportionately injured during the Gulf oil spill in 2010, particularly on barrier and bay islands. We propose to restore some of the species, including Gull-billed, Least, Common, Caspian, Royal, and Sandwich Tern, Reddish Egret, Brown Pelican, American Oystercatcher, Snowy Plover, and Wilson's Plover. National Audubon Society and partners will increase production of birds, reduce mortality, and concomitantly restore and protect habitats on which injured species rely. We will use an adaptive management framework to assess threats, implement strategies to address those threats, monitor success, and adapt both within season where appropriate, and across seasons. We will work on the four key priorities for bird restoration outlined in the PDARP. Priority 1: Restore and conserve bird nesting and foraging habitat. Objectives: At key sites, implement stewardship activities to alleviate dominant threats and improve productivity. Activities: Direct protection of nesting colonies and solitary nesters Predator control Vegetation management Erosion control Outreach and education to increase community cooperation and acceptance Expected Outcomes: Increased productivity of injured birds Priority 2: Establish or re-establish breeding colonies Objectives: Attract colonial nesting species to new or restored islands Activities: Social attraction techniques, including use of decoys and playback of vocalizations Expected Outcomes: Increased number of nesting colonies of injured species Increased probability of region-wide population persistence Priority 3: Prevent incidental bird mortality Objectives: Reduce incidental mortality of coastal waterbirds of all species. Activities: Set up recycling for monofilament line. Educate fishers about dangers of entanglement and reduce barriers to recycling. Expected outcomes: Fishers have increased awareness and compliance with monofilament recycling. Bird mortality from entanglement in m onofilament reduced Priority 4: Address relevant data gaps Objectives: Using the objectives hierarchy established by the Gulf of Mexico Avian Monitoring Network, develop monitoring to fill key knowledge gaps. Activities: Develop standardized protocols for monitoring bird populations and productivity Conduct studies to ascertain the effects of predators, habitat use, and sediment type on bird productivity Expected Outcomes: Improved understanding of Gulf-wide population dynamics Gain knowledge required to prioritize areas for restoration and to develop comprehensive management plans Benefits to Public: Improved management of birds nesting on bay and barrier islands will allow for better balance between species of birds, potentially reducing human-bird conflicts. Recent studies have linked the reduction in coastal birds, lead by the reduction in many of these species of waterbirds, to an explosion in populations of Menhaden, along with a decrease in oil content, quality, and economic value of this important prey species. Restoring balance to this ecosystem by restoring predatory birds will improve livelihoods for fishers and help restore fisheries. Restoring the species harmed during the spill will improve public perception of our coasts as ideal landscapes for living, working, and recreating. It will also improve access to recreation such as bird watching. Benefits to Environment: These species are important as both predators and prey in coastal environments, thus restoring populations of waterbirds will help restore balance to marine fish community structure. Furthermore, the proposed actions will provide benefits to ecosystem services by restoring native vegetation and dune structure and by removing introduced predators that prey on other native vertebrate species. They also disperse aquatic invertebrates, change benthic species composition and abundance, change sediment composition, and improve water quality.	Harrison County,Mobile County,Jefferson Parish,Terrebonne Parish,Galveston County,Calhoun County,Cameron County	$10,000,000
	Mitigation Plan for Leaking Oil and Gas Infrastructure to Compensate for Open Ocean Injuries	This restoration project would protect open ocean as well as nearshore species injured by the Deepwater Horizon oil spill (DWH) from continuing and future oil and gas releases from the hundreds of oil and gas wells and pipelines in the Outer Continental Shelf (OCS) and nearshore areas of the Gulf of Mexico. Some of these installations are leaking periodically or chronically, and others may soon begin to leak. Present and future chronic or episodic leakage from wells and pipelines may affect critical habitats that are already stressed from the larger impacts from the Macondo MC252/Deepwater Horizon (BP) spill, or may even reverse the benefits of restoration projects conducted in the aftermath of that spill. Protection and conservation of habitats and living coastal and marine resources is an essential part of the DWH Natural Resource Damage Assessment (NRDA) Final Restoration Plan for the Gulf of Mexico. One approach to restoration is to actively manage to protect against threats. This project identifies a major threat and a methodology to prioritize mitigation efforts that will most reduce the threat. The project involves analyzing risk from abandoned, orphaned, and currently-active wells and associated pipelines by quantifying the probabilities and causal mechanisms of releases, along with the ongoing and potential future ecological effects of releases in metrics analogous to those used for the DWH injury quantification, allowing benefits of remediation to be measured. Conducting a systematic risk assessment will provide a means to identify wells and pipelines that present the greatest risk, as well as those where responsible parties cannot be identified, so that they can be prioritized for monitoring, mitigation, and remediation efforts. Preventing releases of oil that forms slicks and sheens would be beneficial to early life history stages of fish and invertebrates (e.g., eggs and larvae of tunas, mahi, snappers, sea trouts), among the most vulnerable of open oc ean biota, as well as wildlife (birds, mammals, sea turtles). Assessment of leakage probability for each of the wells and pipelines would be based on expert analyses of available data on well characteristics (e.g., well age, water and well depth, operator(s) through time, hydrocarbon encounter, hydrocarbon characteristics, brine production, acid gas production, completion status, reservoir pressure and temperature through time, geological formation, drive mechanism, tree and wellbore type, and original well type [e.g., exploratory]). Potential effects of discharges of oil and/or gas of different rates and volumes will be analyzed by oil fate and effects modeling, injury quantification and scaling, such as those conducted for NRDA. These metrics, and the protection of offshore and coastal species most injured by the DWH, provides a strong nexus for compensatory restoration.		$700,000
	Flux of Nutrients and Sediments from the outlet of the Mississippi River to nearshore Gulf of Mexico waters	The proposed study addresses the NRDA objective to restore water quality by quantifying nutrient and sediment delivery to Gulf waters. The project will aid in guiding nutrient reduction strategies ultimately aimed at reducing hypoxic zones in the Gulf and improving water quality of nearshore waters. Addressing habitat restoration approaches to protect and conserve marine, coastal, estuarine, and riparian habitats is critical to achieving NRDA restoration objectives. As coastal restoration continues in the Gulf, the need to measure critical water-quality parameters directly at the outlet of the Mississippi River distributaries is becoming increasingly important. Gulf hypoxia is linked to influx of the Mississippi River nutrients and will require a better data record of water quality and quantity inputs into coastal zones at and near the outlet of the Mississippi River to inform restoration. Because many natural and planned diversions of river water will be in the lower-most portion of the Mississippi River, using data from the furthest station downstream on the Mississippi River that currently collects water quality information routinely, at Belle Chasse, is not sufficient to determine chemical and physical changes in the water column near the mouth of the river and fluxes of chemical constituents to nearshore waters. The development of water-quality monitoring to determine the contributions of nutrients and sediments in these areas to nearshore and offshore environments is vital to adaptively manage nutrient reduction efforts to the Gulf. The purpose of this work is to quantify the distribution and relative flux of nutrients and sediments to near shore environments off of the mouth of Mississippi River. The project has two main objectives: 1) extending monitoring of flow, sediment and water-quality downstream from Belle Chase to the mouth of the Mississippi River; and 2) quantitatively and qualitatively distinguishing the river water that enters shallow waters e ast of the Mississippi River for example Breton Sound from that flowing south and west through the main passes. On its eastern side, a longer portion of the Mississippi River is without levees and there is widespread leakage of river water into the adjacent estuarine waters. Little is known about the quantity and quality of this water. The shallow estuaries east of the Mississippi River were an area of widespread environmental damage from the Deepwater Horizon oil spill and understanding water-quality and quantity of this area is fundamental to all restoration activities here, including critical wetland habitats and diverse biota for example the endangered sturgeon. Moreover, understanding how much water and associated sediments and nutrients flow south and west are important to understanding hypoxia formation in offshore waters. We will use a combination of gage installations measuring continuous discharge, turbidity and nitrate and a series of synoptic measurements of these variables at differing stages of the Mississippi river. We will include in these surveys the major distributaries and exit routes of Mississippi River water. Synoptics at high water will focus on the quantity of river water exiting the system. At low water, the distribution of nitrate along vertical transects will be a primary focus, with partitioning into sink and source terms with depth. While installation of a single super-gage on the main channel near the mouth of the river will be considered, we believe using a combination of synoptic measurements at many sites paired with continuous data collection at one or two sites not directly on the main channel will provide a better chance of success for achieving project objectives.	Plaquemines Parish	$1,200,000

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	Pilot Project Linking Offshore to Onshore Water Quality Monitoring	Coastal Louisiana's ecosystems are affected by various stressors, including wetland loss, riverine nutrient loading, hypoxia, oil pollution and climate change. For example, an estimated quarter of Louisiana's wetlands have been lost due to a variety of natural and anthropogenic factors, including erosion caused by the Deepwater Horizon oil spill (DWH; McClenachan et al. 2013, Turner et al. 2016). Large summertime hypoxic zone in the Louisiana's coastal waters causes large-scale spatial population displacements and reduction in growth and reproduction rates of commercially important fish and shrimp species (Craig et al. 2001, Rabalais et al. 2001, Justic et al. 2017). Further, the DWH oil spill caused negative health effects on fish (Dubansky et al. 2013, Incardona et al. 2013), shifts in phytoplankton and microbial communities (Ozhan et al. 2014), and possible stimulation of harmful algal blooms (Bargu et al. 2016). Louisiana's Coastal Master Plan (CPRA 2017) identified a number of river diversion projects that could have multiple potential restoration benefits, including mitigation of wetland loss, improvement of offshore water quality (including mitigation of hypoxia) through enhanced wetland nutrient retention, and protection of wetlands from oil exposure. However, currently there is no monitoring in place to assess water quality changes in the Louisiana nearshore coastal region (barrier islands to shelf). This region is a key intersect for the interactive effects of multiple ecosystem change drivers (e.g., restoration projects, riverine nutrient loading, hypoxia, oil pollution, climate change) on living resources in the North-Central Gulf of Mexico. The objective of this project is to fill the critical water quality monitoring gap by establishing a monitoring transect extending from Barataria Pass, Louisiana, to the inner shelf. Extending the monitoring to this region is vitally important for understanding of: 1) baseline conditions, 2) inshore to offshore w ater quality dynamics, 3) changes in extent and severity of hypoxia, and, 4) far-field effects of restoration projects. This project will serve as a pilot project to investigate the connection between inshore and offshore water quality across a federal-state boundary. The project will monitor nitrogen (NO3, NH4, TN), phosphorous (PO4, TP), silicate (SiO3), dissolved oxygen, temperature, salinity, chlorophyll a, total suspended solids, turbidity, and pH (see map). The monitoring transect will be an open-water complement to the CPRA's estuarine SWAMP program (Hijuelos and Hemmerling 2016). The transect will provide, on an expanded scale, data for isohaline mapping of water quality parameters, and will be invaluable for calibration and validation of riverine, estuarine and coastal numerical models to support management decisions and adaptive management of water quality and fish resources. Bargu, S., Baustian, M.M., Rabalais, N.N., Del Rio, R., Von Korff, B. and Turner, R.E., 2016. Influence of the Mississippi River on Pseudo-nitzschia spp. Abundance and Toxicity in Louisiana Coastal Waters. Estuaries and Coasts, 39(5), pp.1345-1356. Coastal Protection and Restoration Authority (CPRA) of Louisiana. 2017. Louisiana's Comprehensive Master Plan for a Sustainable Coast. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, LA. Craig, K., L. B. Crowder, C. D. Gray, C. J. McDaniel, T. A. Henwood, and J. G. Hanifen. 2001. Ecological effects of hypoxia on fish, sea turtles, and marine mammals in the northwestern Gulf of Mexico. Pages 269–291 in Rabalais NN, Turner RE, eds. Coastal Hypoxia: Consequences for Living Resources and Ecosystems (Coastal and Estuarine Studies 58). Washington (DC): American Geophysical Union. Dubansky, B., Whitehead, A., Miller, J.T., Rice, C.D. and Galvez, F., 2013. Multitissue molecular, genomic, and developmental effects of the Deepwater Horizon oil spill on resident Gulf killifish (Fundulus grandis). Environmental science	Jefferson Parish	$3,000,000
	Establish or expand fisheries observer coverage to assess marine mammal bycatch	There are several commercial fisheries operating in the Gulf of Mexico that have been determined by the National Marine Fisheries Service (NMFS) to have frequent or occasional serious injuries or mortalities of marine mammals. Fisheries are identified as Category I or II fisheries, respectively, under the Marine Mammal Protection Act, and include: • Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery; • Gulf of Mexico gillnet fishery; • Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery; • Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fishery; and • Gulf of Mexico menhaden purse seine fishery. Bycatch of marine mammals in Gulf commercial fisheries has the potential to prevent the recovery and restoration of nearshore and offshore populations that have been reduced due to the oil spill - primarily bottlenose dolphins but also other species such as Atlantic spotted dolphins, pantropical spotted dolphins, pilot whales, Risso's dolphins, and pygmy sperm whales. An expansion of current observer coverage levels is necessary to provide better estimates of marine mammals injured or killed incidental to commercial fishing activities. Expanded observer coverage would also provide additional information needed by managers to determine factors associated with bycatch, such as gear type, time of day, bait type, fishing methods, areas fished, etc., and to identify, test, and implement measures to reduce bycatch. Research and field studies are also needed to identify and test alternative observation methods that could be used to supplement or replace traditional human observers. Such methods may include, but are not limited to, the use of: remote observation platforms, underwater cameras, electronic monitoring, and unoccupied aircraft sysytems (UASs).		
	Research and Outreach to Understand and Minimize Human-Dolphin Interactions	Many areas of the Gulf coast are populated with both tourists and bottlenose dolphins. Interactions between people and dolphins are damaging to the dolphins' natural behavior and put both humans and dolphins at risk for illness, injury, and death. When humans interact with (closely approach and feed) bottlenose dolphins, it causes them to become "conditioned". When dolphins are conditioned, they withdraw from their natural behaviors necessary for survival and instead beg from people for food. Panama City, Florida, is an example of one area where commercial tour operators and recreational boaters regularly interact with dolphins. Commission-funded research has found that interactions between people and dolphins have increased in Panama City over the past 15 years despite education, outreach, and pulsed enforcement efforts. Scientific studies are needed to understand the factors causing an increase in human-dolphin interactions in the Gulf and to identify measures that can effectively minimize those interactions. Those studies should focus on areas such as Panama City where dolphin-watch tours are offered or where human-dolphin interactions routinely occur. Increased outreach efforts are needed to emphasize the harm caused by feeding and harassment of bottlenose dolphins. Those efforts should be directed at tour operators, commercial and recreational fishermen, and recreational boaters, particularly in areas like Panama City with documented high levels of human-dolphin interactions. Economic incentives for responsible tour operations should be encouraged through programs such as Dolphin Smart (http://sanctuaries.noaa.gov/dolphinsmart/). Federal and state enforcement officers should work with resource managers to develop and implement a consistent and effective enforcement strategy targeted at intentional harassment events and repeat offenders.		
	Saturation Diving Capability - U.S. Navy / NOAA Collaboration	Considerable resources will be dedicated to restoration activities in the mesophotic and deep benthic communities affected by DWH. Projects should be planned using technologies that factor in efficiency and capabilities, not only total cost. Saturation diving will allow mesophotic and deep benthic projects to greatly expand their capabilities over unmanned systems, yet at equivalent or lower cost to more-traditional ROV systems. Utilizing Saturation Divers on the bottom will provide unmatched capabilities to meet the goals outlined in Section 5.5.13 of the PDARP, particularly the approach of placing hard ground substrate and transplanting coral for direct restoration actions. Other listed approaches such as community characterization (including genetic studies), improved understanding of foodweb dynamics and trophic connectivity would also be greatly enhanced by the superior collection capabilities offered by Saturation Divers compared to ROVs. The U.S. Navy is eager to support mesophotic and deep benthic projects with the Saturation Fly-Away Diving System (SAT FADS). This system provides manned Saturation Diving capability using a mobile Saturation Diving system to conduct diving operations at depths up to 300 msw for 30 consecutive days using a 6 man dive team conducting continuous Saturation Diving operations. Efficiency is gained through unlimited bottom time and rapid relocation and deployment to multiple project sites within each 30 day Saturation Dive. Extensive communication capability provides real time video and audio transmission between divers and topside scientists to coordinate on-bottom activities. The Navy's SATFADS system is based at the Navy Experimental Diving Unit (NEDU) in Panama City, FL, near the center of expected activities for NRDA mesophotic and deep benthic activities, making mobilization/demobilization cost effective as well. The use of SATFADS will be offered to all NRDA-funded mesophotic and deep benthic projects. The elimina tion of ROV leasing costs for Saturation Diving-supported projects will significantly reduce the individual cost of those projects while the enhanced capabilities of Saturation Divers over machines will greatly increase the efficiency and range of activities undertaken at depth. The program-wide savings will more than offset the SAT FADS costs. NEDU also houses the Ocean Simulation Facility (OSF), a shore based hyperbaric training and testing facility. The OSF may be used to train Navy divers on the assembly, disassembly and service of instrumentation arrays and coral restoration modules deployed by other NRDA-funded mesophotic and deep benthic restoration projects. Much like NASA's training of astronauts in their Neutral Buoyancy Lab prior to space flights, pre-deployment training of Saturation Divers and testing of equipment and procedures will greatly enhance the likelihood of mission success. The Navy is committed to working with scientists from NRDA-selected projects to maximize mission success. This project idea is based upon the Navy providing up to four 30 day Saturation Diving missions per year (consisting of 180-240 days at sea, to include pre and post mission phases) to NRDA-selected mesophotic and deep benthic community projects. NRDA will supply a vessel meeting Navy specifications for load carrying capacity, dynamic positioning capability and the provision of required services (power, berthing, meals, etc.). Saturation Dives may be conducted individually or consecutively, consecutive Saturation Dives require two weeks between each mission.	N/A	$29,100,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Remediation from Organic Loading in Deepwater Marine Sediments	There is a need to address the remediation of marine sediments that have been subjected to excessive loading with organic compounds, particularly in deepwater environments where biodegradation processes are slowed due to low temperature. Organic loading may alter benthic communities by increasing sediment anoxia through microbial biodegradation. Instances of organic loading include the near vicinity to a deepwater seafloor oil spill such as the DWH and around sites where drill cuttings from non-aqueous based drilling mud systems have been discharged, such as decommissioned oil production platforms. Also shallow water, decommissioning of well sites / derelict sites with obstacle avoidance capabilities. Given the problem and the inherent difficulties associated with addressing it, we initiated a joint mechanical and biological technology application program to develop a mitigation methodology that could be applied in these situations. A concept that utilizes proven subsea technology and known scientific principles has been developed. The result and major deliverable of this project will be the further development and proof of concept of a deep-sea bioremediation protocol and the design and validation of the equipment to carry out the process. Our approach is to devise a methodology to accelerate the recovery rate of marine sediments from organic loading. To do this we will integrate biological technology for biodegradation of organic compounds with a mechanical delivery system that can be effectively used in deepwater environments. Our approach is to mechanically inject oxygenated water, as well as having the option of injecting a formulation containing nutrients and biodegradation bacteria seed into the sediments that have been contaminated. This injection will enhance and rejuvenate the biodegradation process with the consequence of reduced recovery time. The takeoff point for development throughout the Phases is that a "mechanical overturning" of the dama ged soil, along with an injection of oxygenated water and the option of a biological agent at the appropriate time and position will be very effective in accelerating the soil's recovery process. This "mechanical overturning" is achieved by the use of an industry-standard crawling remotely operated vehicle (ROV) as the host. The "soil overturning" part of the system would consist of water jets to undercut the damaged soil below the layer of damage and removing deeper uncontaminated sediment as a slurry. This slurry would then be pumped to discharge in a controlled manner over the top of the contaminated sediment. The sediment particles carried in this slurry will settle over the top of the contaminated sediment, effectively "overturning" the sediment. The biological agent could be injected into the covering slurry or independently, whichever proves to be the most desirable. Initially, we propose to answer these questions: • Will the addition of oxygen stimulate more rapid biodegradation, and if so, which is the best delivery method? • Is nutrient amendment required for marine sediments? • Is bioaugmentation required, i.e. will the addition of organisms enriched from one site stimulate degradation at another site (over the natural population)? This study will evaluate the utility of these remediation techniques and provide actionable guidance for their implementation if found to be successful.	Cameron, Vermilion, Iberia, Saint Mary, Terrebonne, Lafourche, Jefferson, Plaquemines, Saint Bernard, Orleans	$850,000
	Targeted Enhancement of the Chandeleur Island Chain: An ecosystem approach	As a result of the Deepwater Horizon oil spill (hereafter the Spill), marine and estuarine ecosystems from Louisiana to Florida, and potentially beyond, were at risk of exposure to and injury from oil discharged from the wellhead as well as injury from a wide variety of Response actions (e.g., chemical dispersants, booming, berm construction, in-situ burning, organized cleanup activities) (PDARP). Within Louisiana, this and related injury was well documented throughout the Breton National Wildlife Refuge specifically within the Chandeleur Island chain. The refuge comprises one of the state's most ecologically diverse coastal communities (e.g., expansive sea grass beds , isolated beaches, abundant seasonal prey base, wide-ranging bird nesting opportunities) which broadly supports a host of endemic and migratory birds and other wildlife species (Appendix A), many of which Trustees documented as impacted in relation to the Spill (PDARP). Examples include: 1.) Critical wintering habitat for various endangered and threatened piping plover subspecies and important wintering and stopover habitat for the threatened red knot; 2.) Only known breeding location of Chandeleur gull (Herring and Kelp Gull hybrid); 3.) Supports the largest breeding colonies of sandwich terns in the world ; and 4.) A primary wintering ground for redheads which forage in GOM sea grass beds. Further, this barrier island chain serves as an important nursery and foraging habitat for many living coastal and marine resources such as birds, turtles, marine mammals, finfish, shellfish and invertebrates (PDARP, Section 5.3.1). Given these and many other beneficial ecological services, Louisiana Trustees propose implementation of multiple restorative approaches within a targeted section of the Chandeleur Island chain; a strategy that clearly addresses the Trustees' overall goal of replenishing and protecting living and coastal resources impacted by the Spill (PDARP). Under a Memorandum of Understanding, Lou isiana Department of Wildlife and Fisheries (LDWF) and the United States Fish and Wildlife Service (hereafter FWS or the Service) manage several state-owned barrier islands are managed as part of Breton NWR. Proposed Restoration for Open Ocean TIG Building on previous and more recent efforts, Louisiana Trustees propose targeted sediment renourishment (~140 acres) within the southern end of the Chandeleur island chain to create a variety of barrier island habitats including beach, dune, and back barrier marshes. Collectively these restoration approaches support stated restoration goals to address bird injury by facilitating additional production opportunities (e.g. terns, skimmers, pelicans, reddish egret, Chandeleur gull etc.), restoring and protecting habitats on which injured birds (e.g. piping plover, red knot, redhead, etc.) heavily rely upon (e.g., beaches, dunes, sea grass beds, backbarrier marshes, etc.) within an area that has historically provided some of greatest avian benefits within the entire Gulf of Mexico (PDARP, Section 5.5.12.1, Remsen et al., 2015). Further, the proposed restoration location will provide additional protection and enhancement for New Harbor Island; the state's easternmost brown pelican and reddish egret rookery and, a potential future restoration location to further address Louisiana's expansive bird injury. In tandem with these efforts, vegetative plantings and sand trapping techniques (e.g. sand fencing) will be implemented within the restoration location as a means to bolster habitat diversity and the island's overall lifespan. Such projects and restoration approaches have been shown to result in positive sand accumulations (up to 4') in some locations, providing short-term elevation increases and thereby creating safer bird nesting areas. Further, these approaches will provide enhancement of critical bird habitats including the Chandeleurs' ecologically valuable sea grass beds.	St. Bernard Parish	$30
	Assessing recovery rates of deepwater organisms in the northern Gulf of Mexico through multigear examinations of species assemblages, community structures, distributions, trophic relationships and interannual variability in abundances.	The Deep Water Horizon (DWH) exploratory well was located in the northern Gulf of Mexico 65 km off the shore of Louisiana in approximately 1,600 m water depth. This region, while relatively close to shore, is not easily sampled due to the water depth and the resultant requirements for the sampling equipment and ships. These difficulties have resulted in infrequent sampling efforts in these deepwater habitats especially in the context of fisheries independent surveys. Thus, when the DWH accident occurred there was a paucity of information relative to the affected communities, particularly in regards to time-series information that would have lent themselves to analysis of impacts to deepwater organisms. In an attempt to characterize the population dynamics and ecology of deepwater ecosystems in the northern Gulf of Mexico, we propose a survey that will deploy a suite of gear types at randomly selected sites between depths of 200 – 2000 m. As this project aims to examine all biological components of these poorly known and infrequently sampled habitats, we propose to deploy multiple gear types to collect information from the surface to the seafloor. We would conduct the survey over 45 days using NMFS RV Southern Journey. Selected gears types will include trawls, longlines, traps, video arrays, water samplers, acoustics and sediment grabs. All captured specimens will be identified to the lowest possible taxa, enumerated and measured. Specimens will be retained for life history, diet, genetic, and toxicology analysis. Water samples will be retained to conduct environmental DNA analyses. In addition to randomly sampled locations, transects will be run in eight cardinal directions (i.e. N, NE, E, SE, S, SW, W and NW) from the location of the DWH spill sight in an effort to determine long-term spatial impacts of the event on deepwater ecosystems. To meet this goal, three unimpacted reference sites will be selected from outside of the influence of the DWH oil spill (e.g. western Gulf of Mexico) and metrics will be developed upon which to compare with impacted locations at and in proximity to the DWH wellhead along the transect lines. Metrics will include categories such as abundance, biomass, trophic composition, diversity of invertebrates and fishes, and habitat mapping characterization and quality. An index of biotic integrity will be calculated for each sampling location that will quantify the degree of site-specific impacts and allow for tracking of recovery rates for each site. Deliverables: • Assess spatial variability in degree of impact of DWH and provide a mechanism to quantify recovery of deep water ecosystems (trawls, longlines, traps, optical, eDNA). • Index of biotic integrity (trawls, longlines, traps, optical, eDNA) • Abundance trends (trawls, longlines, traps, optical) • Species diversity of fish and invertebrates (trawls, longlines, traps, optical, eDNA) • Trophic relationships (diet data, DNA). • Biomass estimates (EK80 broadband acoustics) • Bathymetric mapping (multibeam) • Habitat ground-truthing and characterization (optical, sediment grabs) Performance metrics: • Cruise reports • Annual data inventory, summarization, and project status report • Annual project review and improvement webinar • Final project report • Presentation of results at regional and national meetings • Peer review publications	N/A	$18,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Impact of oil and gas on offshore pelagic and benthic ecosystems	Oil and gas released in offshore ecosystems can have multiple impacts on organisms in the water column and on the sea floor. Research in the Gulf since the Deepwater Horizon oil spill has revealed some of the ways that oil and gas can affect the biological communities of offshore waters, and how the carbon from oil and gas (petrocarbon) can penetrate into and travel through the food webs of offshore ecosystems. We propose two related lines of research: 1. A focused series of measurements of oil and gas impacts around natural seeps via water column and benthic sampling coupled with deployment of time-series sediment traps to capture sinking particles and aggregates, including oil-snow. We will use stable and radioisotope measurements to assess the assimilation of petrocarbon by organisms and transfer of petrocarbon through the pelagic and benthic food webs. We will use genomic approaches to characterize microbial communities and the ways they're altered by exposure to oil and gas. These measurements will be complemented by experimental work to resolve the mechanisms of oil and gas movement into the biota, and the role of biological processes in promoting the vertical sedimentation of oil and oil-derived particles. 2. Benthic surveys to track the distribution and fate of sedimented oil, both around natural seeps and in regions affected by the Deepwater Horizon spill. We will carry out photographic surveys to assess benthic megafauna community composition, density, and health. We will carry out coring surveys to assess the fate of sedimented oil, its impacts on benthic organisms, and its role in supporting sedimentary microbial communities through a combination of geochemical characterization (stable and radiocarbon measurements) and laboratory experiments. The ultimate goal of this research program is to provide basic understanding of the ways that oil and gas alter the composition and function of offshore communities of microbes, phytoplankton, zooplankton , and benthic fauna. This study is timely and will provide critical insights into ecosystem responses to inform future responses to offshore drilling accidents.		$8,000,000
	Reducing Bycatch of Marine Mammals in Commercial and Recreational Fisheries	Marine mammal bycatch refers to any marine mammal adversely affected as a result of being unintentionally entangled, entrapped, ensnared, or caught by nets, lines, traps, or hooks, or otherwise impacted by fishing gear. Bycatch is the greatest direct cause of marine mammal injury and death in the United States and around the world. Bycatch of marine mammals in Gulf of Mexico commercial fisheries has the potential to prevent the recovery and restoration of marine mammals that have been reduced as a result of the Deepwater Horizon oil spill, including bottlenose dolphin (all stocks), Atlantic spotted dolphins, pantropical spotted dolphins, pygmy sperm whales, Risso's dolphins, and short-finned pilot whale. Fisheries of particular concern include the menhaden purse seine, shrimp trawl, shark gillnet, pelagic longline, reef fish, and charter boat/headboat fisheries. Studies are needed in the following areas: • The identification of measures that can be used to reduce bycatch of marine mammals in high priority Gulf of Mexico commercial and recreational fisheries while maintaining the economic viability of those fisheries. Measures to investigate and test could include, but are not limited to, alternative fishing gear and fishing methods, time-area restrictions, and removal of lost or derelict fishing gear (i.e., traps, pots, and gillnets). • Ways to create economic incentives for reducing marine mammal bycatch through, for example, incentive-based fishery bycatch measures. • The ecological effects of fishing on marine mammals, their prey species, and the Gulf of Mexico marine ecosystem.		
	Reducing Red Snapper Discards Using a Collaborative Fishermen's Quota Bank	This project uses an existing Quota Bank to quantify and avoid red snapper bycatch in the commercial grouper-tilefish fishery. The Deepwater Horizon event harmed red snapper, resulting in 55-220 tons of foregone production through direct kills and in longer-term injuries, from decreased reproduction to tissue lesions. Commercial fishermen are working with managers to protect red snapper while the spill's impacts play out. But it'll be difficult to rebuild this fishery without a complete accounting for bycatch in the quota system. This project provides up-to-date data about red snapper bycatch to incorporate into quota-setting. Together with commercial fishermen, managers can proactively reduce red snapper killed through bycatch so the population can continue to recover from the spill. Red snapper managers lack reliable data on red snapper bycatch in the grouper-tilefish fishery, instead extrapolating from observer and self-reported data. This is problematic in light of commercial grouper-tilefish discards. Since red snapper's historical base was in the western Gulf, some eastern Gulf fishermen can't get allocation to retain their red snapper catch. Since discard mortality rates for commercial hook/line fisheries are 55-95%, this means red snapper quotas don't cover all red snapper killed. In order to set quotas accurately and maintain a positive rebuilding trajectory, bycatch in the commercial grouper-tilefish fishery must be accounted for. By quantifying bycatch and discards, this project ensures these dead snapper count toward the quota and are no longer wasted catch. The PDARP specifies that quota banks "can help return injured natural resources and services to baseline and compensate for interim losses by reducing reef fish discards." In 2015, the Gulf of Mexico Reef Fish Shareholders' Alliance launched the first and only Quota Bank in the Gulf. The Quota Bank partners with qualified grouper fishermen in the Eastern Gulf to cover their red snapper bycatch an d assist young red snapper fishermen. There is a growing nationwide movement of permit banks. The Cape Cod Fisheries Trust, in partnership with UMass Dartmouth, proved their scallopers had minimal flounder bycatch in a newly-opened area. Permit banks in three fishing towns provide quota to cover bycatch and spatial management plans through the California Groundfish Collective. Evidence suggests Collective fishermen have less bycatch than non-participants. The Maine Coast Fishermen's Association's building a "risk pool" to help fishermen avoid and account for cod catch. While quota banks are new to the Gulf, they're a well-established tactic for helping fishermen address bycatch. This project uses the Quota Bank to quantify and avoid red snapper bycatch in the grouper-tilefish fishery. It provides up to 100,000 lbs of red snapper allocation to fishermen to cover bycatch, incentivizing participation in bycatch reduction programs, like gear research/modification and hotspot identification, and collecting bycatch data through electronic video monitoring, electronic logbooks, effort-level data collection, and NMFS observer coverage. This is a big incentive- many grouper-tilefish fishermen see discards as a serious inefficiency they're eager to address. The study provides managers with accurate, timely bycatch data. By leasing quota to cover bycatch so red snapper aren't discarded, incidental mortality will decrease, leaving fewer unknown variables for managers. In 2016, the Quota Bank leased nearly 60,000 pounds of red snapper to 20 fishermen in the Gulf. That's nearly 60,000 pounds of red snapper folded into catch shares, no longer discarded at sea. Because mortality levels are so high for commercial hook/line fisheries, if it weren't for the Quota Bank, those 60,000 pounds of red snapper likely would've died and wouldn't have been covered by the quota. The Quota Bank will train participating fishermen in best practices and develop ways to address their bycatch.		$8,500,000
	Using sperm whales as indicators of deep-water Gulf ecosystem health and recovery	Oregon State University has used Argos (satellite-monitored) radio tags to track endangered Gulf of Mexico sperm whales (Physeter macrocephalus) since 2001 (2001-2005 BOEM-funded baseline studies and 2010-2013 BP/NOAA-funded post-DWH studies). Results from 2011 and 2013 archival tags provided high-resolution whale dive profiles, measures of foraging effort and locations. By inference from these data, prey was patchy and often near the seafloor. Since the spill, there has been a 4,000+ km2 low-use area (LUA) for tagged sperm whales, including the DWH site that correlates with contaminated sediments. One 2013-tagged whale crossed the LUA in 3 days with 95% less foraging effort than its weeks of activity outside the LUA. We believe this is related to a trophic cascade in which sperm whales do not use the LUA regularly because the squids they commonly eat near the bottom cannot support themselves on reduced numbers of bottom-dwelling species due to the impacts of oiled sediments. We do not believe this response suggests toxicity issues in the water column. New long-duration, dive-monitoring (DM) satellite tags are the same size as tags we used to track sperm whales for >1 year, but transmit near-real-time dive and foraging summaries. DM tag deployments in 2016 on blue and fin whales produced dive and foraging data for up to 110 days and 7,480 dives/tag. We propose deploying these DM tags on sperm whales adjacent to the LUA every 5 years to determine how long it takes for the benthic communities to recover sufficiently for sperm whales to forage there. The first two taggings will be July-August 2018 and 2023 (8 and 13 years post-spill and 5 and 10 years since our last [2013] data). This is the very first time that a long-term impact to an endangered whale has been well documented, including pre-impact "control" observations, to identify the duration of habitat loss important for predicting oil-related cumulative impact. We suggest tracking whales every 5 years to docum ent this recovery until it is complete. During tagging, we will biopsy whales to determine sex, genetic relationships (kinship), PHC levels from blubber (for possible bio-accumulation close to the LUA) and reproductive hormones to determine ovulating, pregnant or lactating females. Photo-identification and DNA profiling will integrate long-term individual records of Gulf sperm whales. We will collaborate with benthic scientists working to describe relevant ecological relationships (species, sediment PCHs and broader issues to understand the sequence of expected benthic recovery). Ixtoc oil-spill follow-up studies have shown slow sedimentation rates, suggesting that full recovery of benthic "support" species may take 100 years. We seek to estimate "functional" Gulf recovery as demonstrated by the return of an apex predator that integrates the food web literally from bottom to top and in that process transports benthic nutrients to the surface through defecation, enhancing productivity in the photic zone. With each whale consuming 4% of its body weight/day, the hundreds of Gulf sperm whales, weighing 30+ tons are an unusually large transport mechanism for nutrients. We expect smaller sperm whale post-spill home ranges as LUA females pack into still productive adjacent habitats. We also expect a density-dependent effect on carrying capacity with lower fecundity (calving) rates. Home range and fecundity values should normalize as the LUA recovers. Summary: Tagged sperm whales appear to avoid a 4,000+ km2 area with DWH-oiled bottom sediments. By tagging 15 whales close to this area every 5 years, we will document recovery of a trophic cascade (benthic, mid-water and apex predators) in the deep-water Gulf ecosystem to better inform recovery and restoration efforts as well as identify cumulative impact issues if additional spills occur.		$775,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Gulf-wide restoration of fish and invertebrate populations through enhanced monitoring and assessment	The overarching restoration goal of this 15-year project is to facilitate the sustainability and protection of Gulf of Mexico fish and invertebrate populations through improved data collection, stock and ecosystem assessments, and management by filling data gaps that limit our ability for ecosystem restoration. Only a handful of impacted fish and invertebrate populations can be restored by reducing fishing and bycatch mortality. A more comprehensive approach is required to facilitate ecosystem-scale recovery. Accordingly, this project involves a dramatic increase in the quantity and quality of fishery independent data for managed fish and invertebrate populations, their potential prey, and associated habitat quality and abundance throughout the Gulf of Mexico. Through collaborative expansion of the long-running Southeast Area Monitoring and Assessment Program (SEAMAP), a formalized partnership among the five Gulf States, NOAA Fisheries, and the Gulf States Marine Fisheries Commission, existing SEAMAP surveys will be expanded, sampling intensity will be increased, and survey design and sampling methods will be optimized. Concomitantly, the collection and processing of life history data (e.g., age and growth, reproduction, genetics, trophodynamics) will be expanded significantly. In the short term, this project will increase the accuracy and reduce the variability of estimates of key population parameters that are critical for single-species stock assessment. Accordingly, data from this project will contribute to more accurate and timely assessments and implementation of management measures when required, ultimately resulting in restoration of stocks. In the long term, these data will facilitate the transition from single-species management to more holistic ecosystem-level approaches to management, while also enhancing our ability to detect population changes and impacts of restoration efforts at varying spatial scales. To address the most critical needs for assessm ent and management, proposed project efforts will include enhanced habitat mapping efforts, expanded monitoring of reef fish and their associated habitats, expanded monitoring of groundfish populations, expanded monitoring of plankton, expanded monitoring of large demersal and pelagic fishes, incorporation of fisheries acoustics into ongoing surveys, directed sampling and analysis of life history data, and comprehensive statistical and modeling analyses of single-species and multispecies data.		$200,000,000
	Designation of DeSoto and Mississippi Canyons as Marine Protected Areas	DeSoto and Mississippi Canyons provide important habitat for Bryde's whales and sperm whales, respectively, as well as for other oceanic marine mammals and deep-sea coral communities. The northern Gulf of Mexico stock of Bryde's whales inhabits DeSoto Canyon and adjacent continental slope waters extending east and south of the Canyon, and Bryde's whales are the only regularly occurring baleen whale in the Gulf (Rosel and Wilcox 2014, Rosel et al. 2016). The northern Gulf of Mexico stock of sperm whales also represent a distinct stock in the Gulf. Sperm whales are found throughout offshore waters of the Gulf, but the Mississippi Canyon represents an important feeding area (Jochens et al. 2008). Both species of large whales were impacted by the Deepwater Horizon (DWH) oil spill, with estimates of 17 percent of the Bryde's whale population killed and 6 percent of the sperm whale population killed (DWH MMIQT 2015). Mississippi Canyon was subject to intense and prolonged oiling below and at the surface during the spill (Stout et al. 2015). DeSoto Canyon was less heavily contaminated but also experienced oiling at the surface and seafloor (Brooks et al. 2015). Other marine mammals found regularly or occasionally in these areas include Atlantic spotted dolphins, Blainville's beaked whales, Cuvier's beaked whales, Gervais' beaked whales, dwarf and pygmy sperm whales, oceanic and continental shelf stocks of bottlenose dolphins, pantropical spotted dolphins, Risso's dolphins, rough-toothed dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins (Waring et al. 2013). Less is known about the distribution of other oceanic marine mammals within these areas, such as Clymene's dolphins, Fraser's dolphins, killer whales, false killer whales, melon-headed whales, and pygmy killer whales. The designation of marine protected areas was noted by the DWH Trustees as a mechanism for addressing key threats to mesophotic and deep benthic communities (PDARP/PEIS Secti on 5.5.13.3). However, no information was provided in the PDARP/PEIS on what specific areas in the Gulf the Trustees might be considering for such designation. The Commission believes that areas that provide protection for multiple species, including marine mammals, should be priorities for designation. Habitat density maps for sperm whales, Bryde's whales, and other marine mammal species that occur in these areas of the Gulf can be found at: http://seamap.env.duke.edu/models/Duke-EC-GOM-2015/ References: Brooks, G.R., et al. 2015. Sedimentation pulse in the NE Gulf of Mexico following the 2010 DWH blowout. PLoS ONE 10(7):e0132341. DWH MMIQT (Marine Mammal Injury Quantification Team). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. DWH Marine Mammal NRDA Technical Working Group Report. Jochens, A., et al. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis Report. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana; OCS Study MMS 2008-006, 323 pp. Rosel, P.E., and L.A. Wilcox. 2014. Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico. Endangered Species Research 25:19–34. Rosel, P.E., et al. 2016. Status Review of Bryde's Whales (Balaenoptera edeni) in the Gulf of Mexico under the Endangered Species Act. NOAA Technical Memorandum NMFS-SEFSC-692. 133 pp. Stout, S.A., et al. 2015. Spatial extent ("footprint") and volume of Macondo oil found on the deep-sea floor following the Deepwater Horizon oil spill. (CHEM_TR.16). DWH Natural Resource Exposure NRDA Technical Working Group Report. Waring, G.T., et al. (eds). 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2015, 501 pp.		
	Regional training for standardized marine mammal and sea turtle data collection and reporting	Marine mammals, sea turtles, fish, and invertebrates can be affected by episodic and chronic events stemming from natural cause (e.g. hurricanes), human-related causes (e.g oil spills, ocean noise, fishing, marine debris), and combinations of the two (e.g. sea level rise, ocean acidification, erosion of protective wetlands). In all cases, in order to accurately assess the type and amplitude of any stressor, monitoring and data collection must take place over the long term. However, often the data collected on marine species is highly dependent upon the context in which that data were collected. This often leaves potentially significant data out of critical analyses when data were not collected in way that maximizes use and utility across projects; or results in missed opportunities to collect supplementary data. There are several databases available and used for government, university and private surveys, the most notable being the OBIS system. While data centralization is critical for maximum use and access, equally important, is data collection standardization that includes training. This project will assess the past, present and future data collection requirements for marine mammals, sea turtles, sea birds, and whale sharks in the Gulf of Mexico. The main focus will be science- and mitigation-based surveys that are either designed for scientific data collection through surveys for one or more of the select species groups (e.g. NMFS/BOEM stock surveys and University research); or are considered platforms of opportunity for specific industry purposes that could benefit from improved scientific data collection (e.g. seismic mitigation, dredging observation, fisheries observers, Navy observers). The project will create minimum Gulf-wide data collection standards for visual, passive acoustic, and photographic data collection that will be designed to be included, as recommendations, in all activity permits. A comprehensive, on-line data collection training prog ram will be developed with user credentials and expectations established over progressive modules. Specific modules for training spill-related personnel will be developed. From here, data acquisition "apps" such as SeaScribe will be enhanced to capture the larger data collection opportunities in "citizen science" programs or bridge watch programs, but still based on a robust data standard. The benefits from this project is that it establishes data standards that can be cross-referenced throughout the Gulf of Mexico regardless of the project. Standardized data collection, including metadata, will allow States can better coordinate management and assessment of wide-ranging species. While the data will still provide the project-specific information needed, a minimum standard will maximize the utility and sharing of that data. States can better coordinate management and assessment of wide-ranging species. The basis of the project will be a working group made up of researchers, governmental, and industry personnel involved in assessing or managing the species groups in the Gulf of Mexico		$750,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Mapping species distributions and bycatch hotspots using a comprehensive survey database and geostatistical models	As part of a Florida RESTORE Act Centers of Excellence Program (FLRACEP) project, researchers at the University of Miami (UM) compiled a comprehensive survey database including nearly all fishery dependent and independent sources of information on the distribution, density and size-frequency of fish and other species in the Gulf of Mexico (GOM), along with corresponding environmental data. The UM team, along with collaborators at NOAA Fisheries, applied geostatistical modeling techniques to generate seasonal maps for many species, life stages and functional groups, primarily for use as inputs to ecosystem simulation models and to improve monitoring survey design. The proposed project will build on this work to generate predictive maps that will allow fishers to focus their effort on times and places that have high catch rates of target species and life stages while avoiding areas with high bycatch of undersized individuals, spawning fish, or unwanted or protected species. Hotspots of catch and bycatch may be areas where biological and physical conditions cause a species or life stage to be concentrated, such as areas with preferred benthic habitat, eddies or frontal zones where prey species are concentrated, spawning aggregation sites, or migration corridors. The project will develop improved metrics of the physical environment including ocean heat content and distance to fronts inferred from satellite data. Applying geostatistical models to the data from the comprehensive survey database will increase the sample size and precision of estimates of the spatial distributions and the environmental conditions that influence these distributions. We will apply multivariate models, because the distributions of many species are correlated with each other based on similar habitat preferences or predator/prey interactions. This project will primarily focus on species that are of interest to pelagic and bottom longline fishers and are priorities for restoration, including juveniles and adults of billfish, swordfish, tunas and reef fishes, as well as prohibited species such as sea turtles and sea birds. Also, although many broadcast-spawning species in the GOM aggregate to spawn, the locations of spawning aggregations and the geomorphological or environmental conditions that favor spawning aggregations are not well known. Thus, we will map the locations of high densities of spawners of species for which the identification of spawning aggregation sites has been identified as a priority by the Gulf of Mexico Fishery Management Council, including gag, Goliath, yellowedge, and black grouper. For predictions of bycatch hotspots to be useful to help fishers avoid bycatch, the models must have a high predictive accuracy. Thus, we will evaluate how bycatch rates vary across space and time, and how well they are predicted by environmental data. We will use the historical data to estimate how much total bycatch could have been reduced if fishers had avoided areas predicted to have high bycatch according to our predictive models. This will allow us to determine whether and to what extent fishers could reduce bycatch either by avoiding areas that the model predicts will have high bycatch, or simply by moving when they encounter high bycatch rates. To evaluate whether improved data collection would allow for more sophisticated methods to avoid bycatch, we will also use a longline simulator developed by NOAA Fisheries to simulate increased bycatch data and alternative bycatch avoidance scenarios. Because this project focuses on synthesizing existing biological and physical data, we will be able to produce useful maps fairly quickly, and also identify species, life stages and regions for which data are lacking. We will be able to test whether current data are sufficient to make useful predictions about bycatch, and also make recommendations for future data collection to improve bycatch mitigation.		$1,500,000
	Bycatch Mitigation	This idea is proposed under the Open-Ocean TIG restoration project. It is a project that will support restoration through reducing bycatch and bycatch mortality of billfish and sea turtles. The long term goal of this project is to replenish these marine resources, expand to other marine resources, and at the same time enhance recreational opportunities. To achieve this goal the project aims to: 1. use bycatch mitigation strategies and safe-handling measures of billfish that have been identified (such as circle hooks); 2. use bycatch mitigation measures that either prevent capture or promote escape in commercial fisheries using gillnet, longline, and purse seine gears, and 3. implement safe-handling measures to increase survivability post-capture (such as Turtle excluder devices for turtles). This project is innovative in nature as it aims to use outcomes and information from two existing projects: a. a recent inventory conducted of best available science on bycatch mitigation measures across taxa for gears through the review of gear and fishing practice modifications and post-capture release procedures to determine effectiveness in reducing bycatch and increasing post-capture survivability of marine species; and b. an inventory of existing data collection programs in ICCAT fisheries of the Caribbean/Central America States and to improve data reporting in artisanal fisheries in the region. This information will increase the success of the project, reduce collateral damage from implementation, and build from benefits that may be used in a number of species.		
	Use of drone and geo-referenced full motion video (FMV) to maintain cost-effective long term surveillance of stranding events within coastal marsh and shoreline habitats.	Post-DWH spill, significant efforts were expended to detect and identify injured or dead marine wildlife. Much of the potentially oiled wildlife was located within marsh habitats where access was difficult and routine monitoring nearly non-existent. There was question regarding some records, of marine mammals in particular, as to whether the increase in stranding records was the result of oil spill effects or an increased level of search effort. This project proposes to establish a remote survey methodology along roughly 500km of remote marsh and shoreline habitat that are not routinely surveyed by any systematic means or has a low potential of public encounters where stranding reports would be expected. The project will systematically produce a standardized methodology using fixed-wing and multirotor drones equipped with full motion video (FMV) cameras which allows accurate geographic mapping from video taken at any angles (i.e, the image does not need to be taken directly below the camera to be geo-referenced). Establishing this methodology will accomplish three goals: 1) it will provide baseline information regarding stranding events in the deep marsh regions of LA; 2) it will establish, optimized, standardized methodologies of remote surveying and data delivery that can be incorporated for long term monitoring of marine mammal and bird populations in remote regions; and 3) it will provide a proven method to employ for impact surveillance in any future disasters, natural or man-made.	Plaquemines Parish	$580,000
	Restoring leatherback sea turtle abundance by reducing negative interactions with fisheries	Fisheries interact with sea turtles at a disproportionate rate in the northern Gulf of Mexico (nGOM) because the nGOM is extremely productive for a variety of commercially important species (e.g., tunas, snappers, and others), and recent satellite telemetry research has shown that the nGOM is a high-use foraging area for leatherback sea turtles (Aleksa et al. in prep). In the Atlantic, sea turtles often interact with open ocean fronts; however, it has been recognized that the temperature difference at the front can spatially separate turtle foraging and fishing effort, with turtles concentrated on the warm side and fishing on the cold side, thereby reducing sea turtle bycatch, with no adverse effects on fish catches (NOAA unpublished data). A similar process could be occurring in the nGOM, but we currently do not know how the turtles behave in relation to oceanographic parameters. One critical step towards reducing negative interactions between sea turtles and fisheries is to better describe how their movements and behaviors are coupled to physical and biological oceanographic conditions. Leatherback sea turtles, in particular, have wide-ranging, open ocean habitats, but recent analysis of satellite tracking data suggests that they forage in areas close to the shelf edge and slope, presumably because there are higher concentrations of food in these areas (Fossette et al. 2010; Aleksa et al. in prep). These areas also strongly overlap spatially with pelagic longline fishing effort (Garrison and Stokes 2014). Leatherbacks exclusively consume gelatinous animals (also known as "jellies"), but jellies are notoriously difficult to sample accurately because they are destroyed in plankton nets, and many zooplankton surveys do not extend into the shelf-slope transition zone that the turtles consistently inhabit. Here, we propose to use a mesozooplankton imaging system, known as the In Situ Ichthyoplankton Imaging System (ISIIS), to map the vertical and horizontal distribut ions of gelatinous animals, along with synoptic measurements of physical oceanographic parameters, to determine what kinds of habitats and ocean conditions are utilized by leatherback sea turtles. We will couple this information to real-time tracks of leatherback sea turtles in the area and define the types of behaviors displayed by the turtles in the different oceanographic habitats. This detailed information on the turtle habitat use patterns and oceanographic drivers can then be applied to slightly modify shipping or fishing tracks that will reduce the probability of accidental collisions or entanglement and snaring in pelagic longline fisheries (e.g., bycatch), ultimately reducing anthropogenic turtle mortality with negligible impact on economic and fishing activities. The results from this project will produce detailed descriptions of where leatherbacks forage in relation to the distribution of potential prey items. This has direct applications to policy, particularly the precise location of pelagic longline fishing activity that will maximize catch while minimizing the chances to accidentally encounter a leatherback sea turtle. The dataset produced by the ISIIS will be analyzed for gelatinous animals and larval fishes. In addition to these research activities, the image data are complex and contain information on multiple trophic levels, which will create opportunities for researchers interested in all aspects of marine plankton ecology in this physically dynamic oceanographic that has little related field data. Specifically, the data will show the exact location of larval fishes and their relationship to other zooplankton, which would provide insights into the fisheries oceanography of the shelf slope frontal region in the nGOM. We also plan to partner with the University of Southern Mississippi Marine Education Center to give public talks and seminars about the coupling of oceanography to sea turtles and other charismatic animals in the nGOM.		$2,400,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Unmanned Underwater Vehicles - U.S. Navy / NOAA Collaboration	Restoration efforts for mesophotic and deep benthic communities will rely on accurate maps of deep coral sites. Due to the depths involved, acoustic bathymetric mapping from surface vessels is not possible at a resolution sufficient to confirm coral presence. The use of Unmanned Underwater Vehicles (UUVs) is needed to obtain the sub-meter resolution required. Many projects in the mesophotic and deep benthic sector will employ UUVs explicitly for the purpose of high resolution mapping of known and suspected coral sites. Creating a centralized pool of multiple UUV assets with supporting infrastructure and expertise will provide; (1) an economy of scale to reduce costs and (2) standardization of data resolution, mapping and processing protocols, and gear configurations which will allow significantly more effective coordination between projects. The National Unmanned Systems Shared Resource Center (NUSSRC) is located in Panama City, FL. The NUSSRC operates a fleet of 13 vehicles with depth capabilities to 600m and through Memoranda of Agreement/Understanding (MOAs/MOUs) has unrestricted access to vehicles with depth capabilities to 6000m. Available sensor packages include sidescan sonar (SSS), multibeam sonar (MBES), synthetic aperture sonar (SAS), visual and oceanograhic. Existing contracts and relationships with vendors allow rapid acquisition of sensors and/or vehicles to meet nearly all demands foreseeable in mesophotic and deep benthic community research and restoration. NUSSRC offers a completely turn-key solution to the need for high resolution mapping of deep coral systems; equipment, operators, pre-mission planning, post-mission data processing and field and laboratory infrastructure is available from this single source. Section 5.5.13 of the PDARP clearly describes desired restoration activities; nearly all of which will require or greatly benefit from UUV operations producing extremely high resolution bathymetric maps. The leading edge technology ex isting and under development at NUSSRC will allow many of the PDARP goals to be achieved. Certain capabilities may not even be known to scientists proposing research activities. For example, cm-scale resolution SAS mapping could allow monitoring of coral growth rates on restoration models thus obviating the need for expensive ROV surveys. The use of NUSSRC assets will be offered to all NRDA-funded mesophotic and deep benthic projects. NUSSRC's location in a coastal city on the central Gulf of Mexico will enable rapid and economical deployment to any Gulf Coast port deploying NRDA missions. It is anticipated many NRDA-funded restoration activities will have similar deep water mapping requirements. The most logical and parsimonious solution to these needs is a centralized asset pool. The economy of scale, standardization of mapping and turn-key synchronicity of all operational and analytical functions provided by NUSSRC makes it an excellent choice for this asset pool. This project idea is based upon NUSSRC providing 100 days at sea per year with 100m, 600m or 1000m depth-rated vehicles, 10 days at sea per year with 6000m depth-rated vehicles, launch and recovery equipment, and sufficient fully qualified personnel to provide 24 hour operations. NUSSRC will also provide at-sea first order data processing (of sufficient quality to select next day ROV dive sites) and shore-based final data processing. Clear deliverables and performance metrics are easily described for this project. Fully processed maps and imagery will be the primary deliverables. Performance metrics will be the area mapped (total area and area per unit time), the number of missions conducted annually, and the response rate to eligible mapping requests.		$9,320,000
	ModPod: A Pilot Study to Enhance Deep Coral and Fish Abundance in the Mesophotic Zone using a Modular Portable Artificial Reef Design	This proposal supports restoration of mesophotic zone reef ecosystems in the 50-150 m depth zone in the northern Gulf of Mexico, specifically the re-population of reef fishes (Anthiinae, Lutjanidae) and octocorals (Alcyonacea) through placement and recovery of new hard bottom substrate onto the seafloor in the mesophotic reef environment that is 'seeded' with live captured, laboratory grown octocoral fragments and monitored for growth, recruitment, and reproduction. The 5 year pilot study extent will extend over the Pinnacle Trend in the northern Gulf of Mexico. Octocorals of the species known to be damaged by the spill (Swiftia exserta, Hypnogorgia pendula, Thesea nivea) will be captured from areas of high abundance using technical divers, analyzed genetically for a 'native' haplotype, fragmented in the lab, grown to size, and then redeployed adjacent to reef environments. The fragments will be affixed to removable plates hanging on semi-conical cage structures, and grown to maturity in-situ. The reef structures will be surveyed every six months by ROVs and/or technical divers to document rates of growth, recruitment, and larval export.		$5,000,000
	Filling in the gap: Habitat utilization, range and movements of the eastern subgroup of Barataria Bay bottlenose dolphins	Sediment diversions along the lower Mississippi River are currently being considered as a method to create new marsh habitat in Barataria Bay, LA. These diversions will input mass amounts of fresh water into a primarily saline environment that host a variety of fauna, including the Barataria Bay bottlenose dolphins (Tursiops truncatus). It is thought there are three distinct sub-population of bottlenose dolphins in Barataria Bay. Previous research on the western and southern sub-populations have illustrated high sight fidelity towards Barataria Bay and exhibit minimal movements outside of the Bay. However there is little data on habitat utilization, range, and movements of the eastern subgroup, which are most likely to be affected by the freshwater diversion. We propose to assess population size, habitat utilization and range of the eastern-most subgroup of the Barataria Bay bottlenose dolphins. These data will be compared to currently existing data on Barataria Bay dolphins to fill in a known data gap for this unique group. Seasonal and temporal habitat utilization, habitat range, and environmental data will be collected by placing longer-term temporary satellite telemetry data loggers such as SPOTs on individual dolphins (n≤50). Data loggers will be placed on a select number of dolphins during each summer and winter season over a 2 year period (total of 4 deployments). These loggers will transmit data via satellite link during each surfacing for near real-time tracking and monitoring. Four deployments is proposed to account for equipment malfunction or mortality so there will be working data loggers throughout a 2-year period. To obtain a population density estimates of the eastern subgroup, individual dolphins will be identified using a photo capture-mark-recapture techniques from a vessel-based platform. Capture-mark-recapture operations will be conducted every two weeks over a pre-described line transect throughout the study area. All dolphins spotted d uring the survey will be photographed for photo-ID purposes and data will be collected on their behavior, group size, heading, direction, etc. Site condition data will be collected at each sighting to assess sighting rates (i.e., wind speed and direction, glare, wave height, etc.) and water quality parameters (i.e., salinity and temperature). These will aid in determining percentage of error in sighting rates and potential site affinities with regards to salinity and temperature changes. This project is necessary to fill in a vital data gap regarding site fidelity of the eastern subgroup of Barataria Bay bottlenose dolphins. It addresses several specific research needs including the early detection and intervention for anthropogenic and natural threats and monitoring, as well as adaptive management activities to address relevant data gaps to inform restoration plans. We will adhere to quality control and assurance protocols and use previously set standard operating and analysis procedures to ensure these results are comparable with previous research in Barataria Bay, LA and are valuable to NMFS and other key stakeholders.	Plaquemines Parish	$600,000
	Expanding seabird observer placements in support of the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS)	Executive summary: A modest funding request of ~$72K to the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) is requested to more than double spatial and temporal coverage in year 1 of this inter-agency program to better inform restoration actions and decisions for at least 25 injured seabirds listed as "offshore" in Table 4.7-3 of the Final Programmatic Damage Assessment and Restoration Plan (PDARP). Supplemental funding would increase total days surveyed from 90 to 190 in the first full program year, and would be leveraged with up to ~$200K already granted annually for 3 years from Bureau of Ocean Management (BOEM) to the GoMMAPPS component for vessel-based seabird surveys. Proposed work conforms to all protocols and requirements under a GoMMAPPS Seabird Science Plan, and the interagency agreement established between BOEM and U.S. Fish & Wildlife Service (USFWS). Data collected will be used by BOEM to inform NEPA analyses, Exploration Plans (EPs), Development Operations Coordination Document (DOCDs), oil spill risk assessment (OSRA) models, and by the USFWS for Section 7 consultations and planning of O&G activities in the Outer Continental Shelf (OCS) to reduce or mitigate associated impacts to offshore seabirds. Supplemental funding for seabird observers is requested for GoMMAPPS program year 1 only, after which time the principal investigators will re-evaluate (and likely scale back) the scope of seabird observer placement during program years 2 and 3. Background: The Gulf of Mexico (GoM) region is critically important in affording breeding, staging, and wintering habitats for North America's migratory avian resources. Despite the numbers of energy-related platforms and cumulative level of oil and gas activity in the northern GoM region exceeding all other Bureau of Ocean Energy Management regions combined, limited information is still available about the species composition, distribution, and abundance of birds Gulfwide, particularly f or offshore seabirds. Consequently, such information is important for assisting the science foundation and regulatory decision-making by Department of Interior agencies (BOEM, USFWS, U.S. Geological Survey) in relation to offshore resource extraction in an effort to mitigate potential effects to avian resources. Upon completion, the GoMMAPPS Seabird Project is anticipated to be the most spatially and temporally extensive avian research effort in the northern GoM, and is intended to document avian distribution, abundance, and diversity to better inform regulatory decisions that influence conservation of migratory birds.	N/A	$72,436

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Assessing recovery rates of deepwater organisms in the northern Gulf of Mexico through multigear examinations of species assemblages, community structures, distributions, trophic relationships and interannual variability in abundances.	The Deep Water Horizon (DWH) exploratory well was located in the northern Gulf of Mexico 65 km off the shore of Louisiana in approximately 1,600 m water depth. This region, while relatively close to shore, is not easily sampled due to the water depth and the resultant requirements for the sampling equipment and ships. These difficulties have resulted in infrequent sampling efforts in these deepwater habitats especially in the context of fisheries independent surveys. Thus, when the DWH accident occurred there was a paucity of information relative to the affected communities, particularly in regards to time-series information that would have lent themselves to analysis of impacts to deepwater organisms. In an attempt to characterize the population dynamics and ecology of deepwater ecosystems in the northern Gulf of Mexico, we propose a survey that will deploy a suite of gear types at randomly selected sites between depths of 200 – 2000 m. As this project aims to examine all biological components of these poorly known and infrequently sampled habitats, we propose to deploy multiple gear types to collect information from the surface to the seafloor. Selected gears types will include trawls, longlines, traps, video arrays, water samplers, acoustics and sediment grabs. All captured specimens will be identified to the lowest possible taxa, enumerated and measured. Specimens and water samples will be retained for life history, diet, genetic, environmental DNA, and toxicology analyses. In addition to randomly sampled locations, transects will be run in eight cardinal directions (i.e. N, NE, E, SE, S, SW, W and NW) from the location of the DWH spill site in an effort to determine long-term spatial impacts of the event on deepwater ecosystems. To meet this goal, an unimpacted reference site will be selected from outside of the influence of the DWH oil spill (e.g. western Gulf of Mexico) and metrics will be developed upon which to compare with impacted locations at and in pr oximity to the DWH wellhead along the transect lines. Metrics will include categories such as abundance, biomass, trophic composition, diversity of invertebrates and fishes, and habitat mapping characterization and quality. An index of biotic integrity will be calculated for each sampling location that will quantify the degree of site-specific impacts and allow for tracking of recovery rates for each site.	N/A	$18,000,000
	Microscale landers on mesophotic reefs	Documenting fish and invertebrate communities on mespohotic reefs using traditional oceanographic ROV's and research vessels, while successful, is an expensive undertaking. Doing so using deep diving techniques adds a large degree of personnel risk. There may, however, be a faster, cheaper, smaller methodology that may yield comparable results with much lower cost and less risk. Several recent convergences in technology have created the possibility of creating small, easily deployable mini-observatories that would detect telemetered marine life, while recording visual, audio, and physical data over a period of time before being recovered, at a relatively low cost. Vemco Amarix builds an acoustic telemetry receiver with a built in acoustic release (VR2AR). Meanwhile, multiple sources, such as the the Rasberry Pi Foundation, produce minicomputers which would be adaptable to the requirements of an ocean observatory. Mated together (embedding a cased Rasberry Pi, cameras, and sensors into a float around the VR2AR), would create a miniaturized, highly flexible, reusable ocean observatory capable of 500 m deployment, able to be hand launched and recovered from small craft, at a cost of around $6000 each. By keeping the cost low, it would be possible to deploy landers in an array, greatly increasing the amount of data collected and increasing redundancy. Sport fishing charter boats are now capable of handling most wave conditions at speeds over 60 knots. By utilizing fast, stable charter boats, micro-rovs, and hand-launchable and recoverable micro-observatories, researchers could instrument many more mesophotic reefs at much lower costs. By designing the micro-landers around an open-source architecture system, incorporating a standard power package, open-source software, and easily sourced hardware, individual researchers could add whatever sensors they needed to their landers. Working in conjunction with the University of Florida Department of Computer and Electrical En gineering MIST Center, USGS would design, create and test a basic observatory system, with add-on potential for use by other researchers. By deploying many small mulit-sensor landers on mesophotic reefs, we would be able to monitor recovery at longer time scales over larger areas than can be accomplished via ROV missions, at lower cost and with more flexibility.		$2,250,000
	Gulf-wide Investigation of Juvenile Gulf Sturgeon Dynamics and Estuarine Habitat Use	A multitude of restoration projects have been proposed within the footprint of estuarine critical habitat for the federally protected Gulf Sturgeon (GS), thereby triggering regulatory provisions of the Endangered Species Act. Estuaries serve as winter foraging habitat for juvenile sturgeon, yet relatively little is known about the spatiotemporal patterns of estuarine habitat use, or the degree of preference for mesohabitats such as oyster reefs, seagrass beds, or mud flats. This information is critical for guiding projects through the Federal regulatory process, and for determining effective strategies for estuarine restoration to benefit the GS. Also unknown are patterns of recruitment, growth, and survival of juvenile GS, yet this information is fundamental to quantifying the success of Gulf-wide restoration efforts. Following an approach recently demonstrated in the Apalachicola River system, we propose to conduct a multi-year assessment of 1) the spatiotemporal trends in estuarine habitat use by juvenile GS via sonic telemetry and habitat mapping, and 2) trends in Age-1 juvenile sturgeon recruitment, growth, genetics, and survival using proven fisheries techniques across the following 5 GS populations and estuaries: Pearl, Pascaguola, Escambia, Apalachicola, and Suwannee. Most importantly, this project will provide the data necessary to evaluate the impact of restoration projects proposed within the critical estuarine habitat of GS. Also of great importance, this project will establish the necessary baseline for determining whether restoration projects succeed at increasing the production of Gulf Sturgeon, and/or improving the growth rates and survival of juvenile GS in populations affected by the Gulf Oil Spill- the ability to directly measure the effect of restoration projects is critical. This project will also reveal the effective number of spawning adults that successfully contribute to the next generation. This metric will help to evaluate the out come of restoration activities like fish passage/barrier removal projects. This project will be coordinated by a dedicated USFWS biologist, and executed through a cooperative partnership with state, federal, and academic institutions across the northern Gulf of Mexico. The project will leverage the resources of existing projects involving passive telemetry arrays, such as those currently deployed in Lake Pontchartrain and the Pearl River system. Funding for this project will provide the resources and will yield the knowledge and commitments necessary to continue monitoring juvenile GS in these systems into the future, thereby achieving the ultimate goal of assessing effects attributable to Gulf-wide restoration efforts over the long-term. Furthermore, the project will greatly advance our understanding of juvenile GS dynamics and environmental relationships within estuarine habitats, a key objective for recovery of this federally-protected, iconic species.	St. Tammany Parish,Jackson County,Santa Rosa County,Gulf County,Dixie County	$1,150,000
	2018/19 update of NRDA mesophotic reef ROV studies	In 2010, 2011 and 2014, USGS WARC researchers conducted ROV cruises at a series of mesophotic reefs along the NE Gulf shelf edge, from Louisiana to Florida. Changes in fish and invertebrate communities were documented post-Deep Water Horizon, compared to ROV footage obtained at the same reefs between 1997 and 2003. This data was the basis of the PDARP Mesophotic reef section. In 2011 and 2014, detailed images were made of individual corals denoted with anchored markers. It would be necessary, in order to design restoration efforts for mesophotic reefs, to revisit the same sites in 2018/19, to document changes in fish and invertebrate fauna and density, and compare and contrast to the 2011,2012, and 2014 data. If the reefs are recovering on their own, then active restoration will not have to be undertaken, necessitating only continued monitoring of the system. If, on the the other hand, revisiting the sites shows that some components of the ecosystem are not returning on their own, then restoration targets will be able to be set, and plans for active restoration made.		$3,825,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	The complete picture using high resolution digital imagery	High resolution digital Imagery has the ability to fill data gaps and research needs in a wide variety of subject areas in a very quick and efficient way. In the past 9 months, 3 surveys have been carried out in the New York offshore planning area, an area covering 43,000 km2. Two of those surveys have complete datasets georeferenced and partially available to view through a publicly available web portal (https://remote.normandeau.com/nys_public_data.php). Information in the public view includes locations of over 15,000 birds, their flight height and direction of travel when flying, and locations and direction of travel of over 2000 marine mammals, 600 turtles, 1000 large bony fish, 900 cartilaginous fish, and nearly 7000 fish shoals. All are mapped and information is available to be filtered by species, making it possible to associate species presence with sea depth and other important covariates. Jelly fish are visible in the imagery, and also collected and mapped are images of boating traffic. In the fall survey, active gill net, trawler, commercial shell fishing, and recreational vessels were identified and mapped. Although these are not available in the public view, they contribute a key piece of the puzzle of what is where and why. These kinds of data are exactly what are needed in the Gulf of Mexico, to form a complete picture of how the Gulf is being used. Data collected now can be used to monitor the future success or failure of the many projects that are currently targeted to improve the overall health of the ecosystem and maintain and increase the diversity and density of animals using the Gulf of Mexico. This is the basis of this project idea. A BOEM study completed in 2013 (https://www.boem.gov/ESPIS/5/5272.pdf) found that turtle densities were under-recorded by between 4x and 10x when data were collected by visual methods using low altitude aircraft or boats. Primary reasons for this were repulsion from the survey vessel (i.e. the animals dived), and opacity of the water column from an oblique view (boat observers can't see down). The behavior of marine mammals is also influenced by vessel traffic. The same study found that estimated densities of dolphins were potentially inflated by attraction to the boat survey vessel. The camera technology available today provides massive megapixel sensors and allows for ultra high resolution, revolutionizing imagery as an efficient data collection method. The recent New York study is identifying over 90% of birds to species, and even finding flight heights for around 70% of flying birds (https://remote.normandeau.com/docs/NYSERDA%20Fall%202016_Taxonomic%20Analysis%20Summary%20Report.pdf). Marine mammal and turtle identifications are also high, with success influenced primarily by subsurface depth obscuring important diagnostic features of similar species (i.e. beaked whales). It takes 9 days to collect data across the New York offshore planning area (https://remote.normandeau.com/nys_overview.php). Vast areas of the Gulf of Mexico could have essential, very detailed data collected very quickly and efficiently. The use of high altitude (1360 feet) and high resolution (1.5 cm or better) allows detailed surveys to be provided across state and federal borders, with results highlighting patterns across the entire Gulf of Mexico. Using zigzag transect design and stopping at strategic coastal airport locations en route, the entire area from Florida to Texas could be relatively easily and quickly surveyed depending on the percent coverage deemed appropriate. Multiple seasonal surveys in a year would allow observation of variations in interseasonal and interannual density, diversity and distribution as well as identifying hotspots of foraging activity, prey locations, and anthropogenic use. The method would provide much needed data in places where data are not only sparse but frequently absent.		$5,000,000
	Unified Gulf of Mexico Benthic Habitat Map	Habitat maps of varying quality and coverage exist in different federal, state, industry, and academic repositories, yet habitat mapping coverage in the Gulf of Mexico – particularly of deepwater areas – is far from complete. Traditional acoustic mapping techniques (e.g., multibeam and sidescan sonar, LIDAR, other remote sensing), groundtruthing, and other direct benthic data collection and processing methods have been deployed sporadically and opportunistically in the Gulf of Mexico, due in large part to their high cost. DWH injury assessment and restoration have created a new urgency for, and new partnerships around habitat mapping. This project will bring together an inventory of existing data, and establish a community through which we can share, reprocess, digitize and modernize this information in support of a single baseline map to serve as source information for activities to come (including a collaborative partnership or community of practice for data sharing and prioritization of future habitat mapping efforts).		$500,000
	Impact of Exotic/Invasive Scale on Estuarine Phragmites Marsh on Delta NWR	The Mississippi River birdsfoot delta provides habitat for a wide array of estuarine and open ocean dependent species of birds, fish, and invertebrates. Hydrologic disruptions and coastal erosion of the estuarine marshes have led to large losses of this important habitat. This loss is expected to increase and accelerate with the recent arrival of an invasive scale insect which attacks roseau cane (Phragmites spp.). Roseau cane is the dominant vegetation type over many tens of thousands of acres on Delta National Wildlife Refuge (refuge) and throughout large portions of coastal Louisiana. These marshes stabilize and protect the muck soils found in many areas and consist of a matrix of both submerged aquatic vegetation and emergent marsh vegetation. These habitats provide spawning and nursery habitat for a number of coastal and open ocean species of fish and invertebrates including several commercially important species such as white and brown shrimp and blue crab. Project is in an area and marsh type directly impacted by the Gulf Spill. This project would build upon a three (3) year study completed in the fall of 2016 which tracked the growth and health of roseau cane in select areas within the refuge. These areas have recently been invaded by the scale insect and represent a unique opportunity to track the fate and potential recovery of roseau cane through both pre- and post-infestation data. Project would provide for 2 aerial overflights to map extent and possible future spread of impacted areas. It would also provide for the collection and analysis of 3 years of vegetation data designed to track the health, growth, fate, and possible early recovery rates of impacted marshes. Initial study was funded by private industry and through in-kind contributions of NOAA and the USFWS. Contributions toward initial study included: Private Industry - $100,000.00 NOAA - In-kind services of personnel for field investigation, project design, sampling protocols review USFWS - in-kind services of personnel	Plaquemines Parish	$100,000
	Facilitating Open Ocean project support: Peer review, project evaluation, stakeholder facilitation, and administrative services for bird restoration in Deepwater Horizon Trustee Implementation Groups	Executive summary: Restoration programs exact an adherence to statutory obligations as well as public accountability, transparency, and participation in the process itself. Terra Mar Applied Sciences, LLC, proposes to adopt and apply an administrative model used effectively by the Exxon Valdez Oil Spill Trustee Council to furnish peer-review, project evaluation, and other support services for program components of the Open Ocean (and potentially other) Trustee Implementation Groups (TIGs) that oversee bird restoration after the Deepwater Horizon incident. Scope for these services would cover primarily those injured bird species that do not nest in Gulf states. Project period would run at least five (5) years, be implemented in stages using standards of peer expertise, accountability, and transparency, and rely substantially on existing stakeholder networks to enhance synergies for optimizing long-term restoration success. Roles and responsibilities for Terra Mar would include: 1) designing and conducting an independent, expert peer review system for avian monitoring, research, and/or restoration projects on behalf of TIG(s); 2) evaluating the recurring or completed bird restoration projects on behalf of TIG(s); 3) building and facilitating a network of practitioners to work collaboratively towards the TIGs' identified restoration goals; and 4) organizing and/or hosting workshops, symposia, or conference sessions to report out the TIGs' restoration achievements in publically-accessible venues. All decision-making authority for restoration projects and funding allocations would reside solely with the TIGs. Terra Mar would furnish regular, expert guidance to TIGs about priority-setting methodology, furnish design input on crafting requests for proposals (RFPs), and help craft criteria for proposal evaluation, make recommendations to improve project quality, and facilitate a participatory administrative and project selection process that fosters wide public involvement and encourages a broad sense of ownership in the restoration outcomes for open ocean bird species. Rationale: Dimensions of the Deepwater Horizon blow out and the subsequent oil spill, both temporally and spatially, were such that birds and their habitats were affected over an unprecedented geographic scale. Consequently, achieving restoration under these particular conditions is fraught with substantial logistical obstacles: 1) the daunting scope and scale of the Gulf ecosystem itself as well as the range of open ocean bird species affected; (2) the very large number of partners, stakeholders, and kinds of expertise that are involved, including collaboration with international teams; and (3) the amount of funding ultimately needed to successfully design and implement a comprehensive, Gulf-wide avian monitoring program (e.g., GoMAMN 2017). Of the 25 species identified as primarily offshore and targeted for restoration (Table 4.7-3 of the Final Programmatic Damage Assessment and Restoration Plan), some 15 of those species breed entirely or mostly outside the jurisdictions of the five Gulf states affected by the spill, or outside the jurisdiction of the U.S. entirely. Consequently, the types and diversity of professional expertise required to implement a truly comprehensive restoration program must, necessarily, involve many actors, organizations, types of research specialties, and working beyond U.S. borders.	n/a	$1,511,725

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Restoration in Place Strategy for the Deep-sea Soft-Bottom Benthos: Long-term Monitoring to Support Restoration Efforts	The Deepwater Horizon (DWH) incident in the northern Gulf of Mexico (GOM) occurred on April 20, 2010 at a water depth of 1525 meters, in Mississippi Canyon Block 252, releasing an estimated 3.19 million barrels of oil over the following 87 days. As part of the Natural Resource Damage Assessment (NRDA) process, a study comprising three field surveys (2010, 2011, and 2014) was conducted to identify effects of the spill on the deep-sea, soft-bottom benthos and sediment quality. Results revealed a zone of severe to moderate impacts on biodiversity linked to the DWH wellhead that persisted through 2014. Thus, an obvious restoration goal for the deep sea is to return biodiversity and other key benthic attributes to normal reference-range conditions. It is hypothesized that burial of the damaged habitat by natural deposition processes will cap the damaged sediment and restore the benthos to background conditions. The obvious question is: how much sediment is needed to cap the DWH contamination, and long will this take? Based on the NRDA studies, 95% of the benthos is within the top 10 cm of sediment. A recent examination of deep-sea sediments in the area of the 1979 Ixtoc spill, found 4 cm of fresh sediment on top of the damaged sediment. Using this rate, it is hypothesized that it will take another 65 years to have a total of 10 cm at the Ixtoc site, which implies it takes about 100 years for deep-sea sediments to recover naturally. Thus, the restoration strategy for deep-sea soft-bottom benthos must be a long-term study to monitor the recovery rate and verify that this assumption is correct. Now is the time to begin planning specific projects for the open ocean and deep-sea benthos, because the Damage Assessment and Program Restoration (DARP) report is complete and the Open Ocean Restoration activities are being developed. However, two challenges exist: (1) rates of change in the deep sea are very slow, and (2) we know very little about temporal dynamics in the deep sea Gulf of Mexico. Until we understand basic temporal dynamics, it will be difficult, if not impossible, to ascertain if change is a result of recovery, seasonal dynamics, or year-to-year variability. Thus, the proposed sampling strategy includes both a long-term monitoring strategy to measure recovery and a short-tem experiment to identify temporal dynamics. A third component of the strategy is to analyze archived samples of opportunity collected in 2015, 2016, and 2017 during Gulf of Mexico Research Initiative (GOMRI) funded cruises, where analyses of the benthic samples were not funded. The long-term monitoring study would include sampling 34 NRDA stations bi-annually (every 2 years) until recovery occurs (or for the length of the RESTORE program, which-ever occurs first). The 34 stations consist of 20 moderately and severely impacted sites, and 14 non-impacted sites. Spatial coverage across the treatment categories is necessary as a basis for comparing impacted versus non-impacted areas. The temporal dynamics experiment would entail quarterly sampling over two years at six stations. Quarterly sampling is necessary to identify if seasonality exists, and a two-year cycle is required to confirm that the patterns are repeatable. Three stations in the heavily impacted zone and three stations from non-impacted zone would be sampled in order to determine recovery based on whether spatial differences between treatments are distinguishable from natural temporal dynamics. The analysis of archived GOMRI samples will extend the NRDA time series and act as a segue to RESTORE funded monitoring. The GOMRI project was funded to perform the benthic analyses at the Ixtoc oil spill site, but additional samples were collected in the northern GOM near the DWH spill site. For all three studies, the independent variables to be measured include: benthic macrofauna (taxa richness and total faunal abundance), benthic meiofauna (taxa richness, total faunal abundance, a		$52,000,000
	Delta National Wildlife Refuge Hydrologic, Shoreline, and Estuarine System Restoration	The Mississippi River birdsfoot delta provides habitat for a wide array of estuarine and open ocean dependent species of birds, fish, and invertebrates. Hydrologic disruptions and coastal erosion of the estuarine marshes have led to large losses of this important habitat. This loss is expected to increase with the recent arrival of an invasive scale insect which attacks roseau cane (Phragmites spp.). The major passes or channels of the delta have infilled with material for a number of reasons and now prevent the seaward flow and deposition of river sediments into receiving ponds and bays. Project would dredge the major passes which bisect the delta, restoring hydrologic flow and sediment transport, and deposit that material in a manner which rebuilds and stabilizes eroding shorelines on the seaward edge of the delta. Project would enhance transport and natural deposition of river sediments while protecting existing shorelines and estuarine marshes. Newly created shoreline/islands provide nesting, loafing, and wintering habitat for a number of colonial nesting seabirds, shorebirds and other estuarine dependent species of birds. Protection of marshes and interior ponds and bays will serve to promote growth of submerged aquatic vegetation and emergent marsh vegetation which provide spawning and nursery habitat for a number of coastal and open ocean species of fish and invertebrates including several commercially important species such as white and brown shrimp and blue crab. Project can be easily scaled up or down during each phase based on available funding and project contract costs. Project would be constructed in phases over the course of 10-15 years and would include areas on both Delta National Wildlife Refuge (USFWS) and Pass-a-Loutre Wildlife Management Area (Louisiana Department of Wildlife and Fisheries). Phase 1 would place material along approximately 4 miles of shoreline beginning at the north bank of Pass-a-Loutre pass at the south-east boundary of the refuge. Material would be placed in a linear band to a width of 400 feet and initial pump height of 5-7 feet along the centerline. Material would be placed unconfined and allowed to seek natural slope. Each mile of material placed in this configuration would create approximately 50 acres of subaerial habitat for a total construction of approximately 200 acres of subaerial habitat. In addition tidal and subtidal mudflats and shallow water habitats would be created on each side of the band as pumped material slopes outward. Protective shoreline would decrease wave fetch and promote the establishment and growth of submerged aquatic vegetation in interior bays and ponds. Fish passage features would be created at predetermined intervals, interval and design to be determined in consultation with NOAA National Marine Fisheries staff. Future phases would create up to 40 miles of similar features/habitat over the course of next 15 years if funded during future funding cycles.	Plaquemines Parish	$10,000,000
	Migratory Species Studies	Expand Gulf of Mexico Migratory Species Pathways Mapping and Conservation Project with emphasis on migratory connectivity modeling, threats assessment, and the identification of habitat restoration needs including pelagic habitat. a. Objectives: Understand the most significant migratory pathways of fish, Sea Turtles, Marine Mammals, and birds in the Gulf of Mexico large marine ecosystem, and the habitats that their populations need to continue being viable; identify the most important threats to those pathways and habitats. b. Species group/habitat: Fish and Water Column Invertebrates, Sea Turtles, Marine Mammals. c. Description: Migratory species rely on multiple habitats to complete their life cycles. This project should: i. Assess the threats to species while migrating (along their pathways) in the Gulf of Mexico ii. Develop an optimized habitat portfolio using GIS and migratory connectivity models that identify the essential habitats to maintain migratory species populations throughout their life cycle and to guide habitat restoration and protection. iii. Support technological advancements in the development of biological tracking and oceanographic monitoring networks, such as acoustic monitoring networks, gliders including the development of migratory movement tracking networks and infrastructure across the Gulf. To do that it should fund: current or new establishment of scientific and management networks of practitioners assessing the movements of marine organisms (e.g., iTAG network of acoustic telemetry) and synthesis of a collaborative strategy for a Gulf of Mexico Animal Tracking Network. The project continues work previously completed and published by The Nature Conservancy to map the migration routes of 26 bird, fish, marine mammal and turtle species in the Gulf of Mexico (Brenner et al. 2016). We believe that this research revealed the great importance of species migration to the Gulf ecosystem as well as the importance of continuing to com pile and analyze migratory pathways as an important decision-making tool for Gulf restoration. This project would accomplish the next phase of this work with particular emphasis on threat assessment and identification of the most critical migratory pathways for protection for their habitats. (Brenner, J., C. Voight, and D. Mehlman, 2016 Migratory Species in the Gulf of Mexico Large Marine Ecoystem: Pathways, Threats, and Conservation. The Nature Conservancy, Arlington, VA. 93 pp.)		$1,200,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Gulf MetaCode (GMeC): Next Gen Census and Long-Term Monitoring of Florida's Gulf Biodiversity	There are roughly 10,600 species of fish and invertebrates known from the Gulf of Mexico, over 9,000 of which are invertebrates. Although initiatives are providing an organized taxonomic and biogeographic framework to increase knowledge on the constituents of the Gulf of Mexico's faunal communities—i.e., what species are there and where they occur—there is not a centralized initiative that will link this framework to applied ecological and management research. The link would be expertly identified voucher specimens with associated DNA sequence data, and the most efficacious applied biodiversity and fisheries research would involve using environmental sampling and metabarcoding to rapidly monitor biodiversity. This monitoring would inform policymakers on changes in species composition and relative abundance of the ecosystem through time. The two objectives of this project are: 1) to produce a DNA sequence library to identify species, and 2) to use this resource and new technology to rapidly assess biodiversity of Gulf communities at standardized spatial and temporal intervals. DNA barcoding has been useful in an various scientific studies such as detecting seafood fraud, biodiversity assessments, and metabarcoding studies. The applicability of these data has spurred large-scale initiatives to census biodiversity (Moorea Biocode Project and the International Barcode of Life Initiative). Building a DNA sequence library would involve using existing natural history collection material [FWRI and the Florida Museum of Natural History (FLMNH)] and comprehensive field sampling to census the Gulf of Mexico's biodiversity. Preliminary data from the east coast of Florida indicate that roughly 80 percent of species cannot be identified using existing DNA sequence databases. Most marine invertebrates have planktonic larvae and the east and west coasts of Florida have similar faunas that are probably equally represented in terms of available DNA sequence coverage. Given these assu mptions, 80 percent of the Florida Gulf Coast fauna has likely not been sequenced. This project seeks support to build a DNA sequence library using two or three molecular markers per species. Invertebrates will be targeted but gaps in sequence data of fish will be filled as well. The census will advance all aspects of biodiversity and fisheries research in perpetuity as a rapid identification tool of the Gulf's fauna—prey items, cryptic species and other difficult to identify species, etc. The library and associated voucher and locality data will be linked to existing cyberinfrastructure including BOLD, OBIS, Genbank, and iDigBio for dissemination. Furthermore, the library will enhance the second component of the proposed project: monitoring Florida's Gulf communities using environmental metabarcoding. Metabarcoding is a new method to rapidly assess biodiversity of an ecosystem from environmental samples. Whole samples, such as fish gut contents or plankton tows, can be extracted, mass amplified, and sequenced using high through-put, next generation sequencing. The outcome is a list of sequences found in the sample—e.g., biodiversity of prey items in a red snapper's gut—useful for measuring species composition and relative abundance. The proposed project hinges on the development of the aforementioned DNA sequence library for identification of environmental DNA. It also hinges on four standardized environmental sampling methods: fish gut contents, sediment samples, Autonomous Reef Monitoring Structures (ARMS), and plankton tows. Using all of these methods, combined with traditional biodiversity sampling to builda DNA sequence library, will provide system-wide, rapid data across trophic levels, habitats, and other environmental gradients through time, yielding a comprehensive picture of biodiversity in a system.		$939,000
	Marsh loss in Barataria Bay due to the Deepwater Horizon Oil Spill	Substantial coastal wetland loss caused by the Deepwater Horizon (DWH) oil spill were not included Natural Resource Damage Assessment. Studies published in 2016 and 2017 proved that DWH oiling dramatically heightened shoreline erosion, erosion magnitude increased with oiling severity, and oil related erosion distinctly differed from storm related shoreline erosion. These first-time findings were provided by a designed operational mapping system which used Synthetic Aperture Radar (SAR) data within a remote sensing and GIS processing structure. That system delivered a holistic representation of spatial and temporal trends of shoreline lateral movement that were not obtainable from ground measurements. A separate study also published in 2016 uncovered a pattern of backshore marsh density decrease that aligned spatially with shorelines that were heavily oiled the previous year. These results document substantial wetland loss due to DWH oil spill and possible latent detrimental response of marsh exposed to moderate oiling. While the mapping demonstration was highly successful, the extent and temporal duration were limited. The goal of this proposed project is to fully document marsh degradation and loss due to DWH oil in Barataria Bay from 2010 to 2016, and to chronic and storm erosion. In order to accomplish that goal, the project region will be extended from the northeast corner to include all of Barataria Bay exposed to DWH oil in 2010. The first project objective is to compile all needed field and image data to carry-out all mapping. SAR images used to conduct the previous studies were collected yearly of the Bay from 2009 (pre-spill year without storms) to 2016. Yearly SAR marsh density mapping will be based on calibrations performed with 2010 to 2012 field data collections. The second objective is to produce high-fidelity 2-m ground resolution SAR images that are then mosaicked to form yearly 2009 to 2016 georeferenced maps of the Bay. The third objective is to produce yearly SAR-based shoreline vectors and calculate a reference vector from which to measure shoreline movement throughout the Bay. The fourth objective is to setup and apply a GIS procedure for automated measurement of shoreline lateral movement from year to year. The fifth objective is to create yearly maps of marsh density and year-to-year change maps. Produced maps, tables and analyses will substantially increase the direct morphological impacts of the oil spill, expanding the possibilities of long-term environmental consequences. The comprehensive accountability of marsh degradation and loss will directly record the vulnerability and resilience of natural coastal wetlands to man-made and natural disasters and chronic and storm erosion. This direct record will increase the ability to anticipate and better protect the wetlands from immediate and long-term consequences promoting sustainability of the coastal ecosystem.	Plaquemines Parish	$550,000
	Development of Tools to Operate the Mid-Barataria Sediment Diversion For Maximum Sediment Delivery and Minimum Freshwater Input	The mid-Barataria Sediment Diversion will reconnect the Mississippi River to the adjacent estuary. This area of freshwater and brackish marshes has been degrading since the construction of levees along the Mississippi River that has reduced inputs of freshwater and sediment to these wetlands. The combination of subsidence and regional sea-level rise has resulting in the loss of land and habitat. Input of sediment and freshwater from the diversion is anticipated to reduce and in places reverse these losses. The diversion management goals are to maximize sediment movement while minimizing the amount of water diverted. The diversion project is scheduled for completion in 2022, at a cost of $1.3B. The effectiveness of the diversion is dependent upon many issues and processes. Most importantly, the project must enhance mineral sediment deposition in marshes brought about by increased sediment delivery to the basin while minimizing potential negative impacts to belowground plant production brought about by increased flooding and nutrient loading. Studies of prior diversions indicate that the impact area of increased water levels may greatly exceed that of deposited sediment. Many marshes consist of high-porosity organic material and additions of mineral-based sediment may infiltrate pore space (thereby increasing bulk density), rather than create an immobile layer on the marsh surface that contributes to vertical accretion. Freshwater marshes are sensitive to saltwater intrusion, while brackish and saltmarshes can be vulnerable to prolonged periods (a week or more) of continuous flooding. Moreover, inputs of diverted nutrients into warm, shallow bays could help facilitate nuisance algal blooms and possibly hypoxic conditions in addition to be detrimental to below-ground productivity of marsh vegetation in unpredictable ways. While diverted river water may impact the estuary and marshes in the above described ways, nutrient transport directly to the northern Gulf of Mexico could be reduced and possibly result in a reduction of the areal extent of the hypoxic zone. The current science available thus suggests that benefits of the mid-Barataria diversion may be optimized by maximizing sediment delivery while simultaneously minimizing the duration and extent of freshwater inflow. Purpose and Scope: This project intends to (1) provide tools for informing the timing, magnitude and duration of diversion operations to maximize sediment delivery with minimal freshwater influx, and (2) provide baseline data on flux of material materials through the basin to help assess the diversion's impact to these fluxes and the spatial extent of these fluxes once the diversion becomes operational. The proposed work and tools developed will complement and improve existing monitoring programs by the Louisiana Coastal Protection Restoration Authority such as the Louisiana's System-wide Assessment and Monitoring Program (SWAMP) and the Coastwide Reference Monitoring System (CRMS). The information obtained will be critical to the project's adaptive management program, which could include outfall management measures to optimize flow routing through the system. The first phase of the project will assess the flux of freshwater, sediment, and nutrients through the basin that is currently (prior to diversion operations) driven by astronomical tides and wind. These baseline data will be necessary to quantify impacts of the diversion to nutrient fluxes through the tidal passes to the northern Gulf of Mexico. Only through informed adaptive management can diversion operations be tuned to maximize land building and marsh habitat restoration and productivity while minimizing potential adverse effects of excessive nutrients and inundation. The approach described here will be transferable to future diversion projects (e.g., mid-Breton). Management Question The project will provide baseline (pre-construction) data necessary for optimizing operation of the mid-Barataria s		$3

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Ecological responses to freshwater diversions in Barataria Bay and surrounding areas	Louisiana is moving forward with the design, engineering, and construction of several large-scale sediment diversions adjacent to the Mississippi River. More information is needed to understand the nature and degree of ecological changes that can occur in receiving estuarine environments and for such predictions. We propose to assess estuarine health at sites near Fort Saint Phillip where passive breaches in the Mississippi River levy have resulted in large influxes of freshwater into the lower sections of Breton Sound. Biological, chemical and physical (habitat) characteristics will be measured in response to the long-term influx of freshwater and sediment from the Mississippi River, as opposed to sites isolated from any direct river water influx. Conditions at these sites will be compared to those adjacent to, and downstream of, the proposed outfall of the mid-Barataria diversion. The intent of our multi-parameter, inter-disciplinary design is twofold: (1) to document and compare the conditions at estuarine sites receiving freshwater and (2) to document baseline conditions for the Barataria Bay estuary. Moreover, by way of these observations across the fresh- to salt water gradients, models will be applied to the data for use in predicting the likelihood of changes for other estuaries receiving diverted freshwater. The null hypothesis is that biological, chemical, and physical conditions will not change substantially at estuarine sites receiving diverted freshwater and sediment. Site conditions encountered at sites located across the fresh- to salt water gradient will be compared using integrated data and ecological modeling. Over a period of 3 years, 12 sites, approximately split between the eastern and western Mississippi River will be sampled. Monthly data will be collected on nutrients, suspended sediment, and chlorophyll a. with concurrent field readings on dissolved oxygen, pH, salinity, conductivity, and turbidity. Sediment accumulation will be meas ured and samples analyzed for organic compounds and metals, annually. Each spring and fall (under similar tidal conditions), water current (direction and velocities) will be measured with Acoustic Doppler Current Profilers (ADCPs) at transects to determine hydrologic characters that can influence water quality. Depth profiles by the ADCPs will generate bathymetry parameters over the period of study. Fish, benthic (infaunal and epifaunal) invertebrates, and bacteria (measured using metabolic activity in water and sediment) metrics will be compared to chemical and physical measures and will be used as ecological end points. Suspended sediment and chlorophyll a data collected for this study will be used to develop algorithms for estimating those constituents using remote sensing techniques. This project also will build upon a recently developed hydrodynamic-water quality-oyster population coupled modeling system for Breton Sound that can help provide understanding for how oyster population characteristics (growth, mortality, recruitment) and other characteristics support adaptive management strategies for future restoration projects. This project is complimentary to several other ongoing projects and plans in Louisiana. It addresses several specific research needs listed in the Research Strategy identified in the RESTORE Act which are relevant to the Louisiana's Coastal Master Plan. Our sampling strategy will be more intense and cover a smaller area than SWAMP and CRMS. Adherence to quality control and assurance protocols, and specific standardized operating procedures, ensures that our project will provide data valuable to SWAMP and to CRMS. Results will tie directly to the Trustee approach of broad perspective, ecosystem-level considerations. Such process-driven, systematic modeling approaches have not yet been applied in coastal master plan applications, but is envisioned as a pathway forward for coastal master plan development.	Plaquemines Parish	$1,360,000
	Predicting Oiled-Marsh Erosion through Integration of Field Observations, Hydrodynamic Modeling and Remote Sensing of Coastal Wetlands	Currently there are no predictive tools that can be used to assess and predict the long-term impact of the oil spill on marsh edge erosion and wetland shoreline stability. One of the reasons for the absence of a predictive model for oiled-marsh erosion is the disparity and disconnect between the physical, biological, and chemical data as well as various studies. From coastal restoration and protection perspective, there is a critical need to improve the fundamental understanding of marsh edge erosion under various physical and ecological conditions such as wave energy, soil strength and vegetation biomass to develop a more robust predictive tool for the Coastal Master Plan. The goal of the proposed project is to synthesize and integrate field observations, numerical modeling results and remote sensing data aimed at developing a reliable model for the prediction of oiled-marsh edge erosion, which will serve as a useful tool for assessing the long-term resilience of coastal marshes in Louisiana and beyond. To achieve this goal, three objectives are formulated for the proposed project: 1) to collect and integrate wetland soil, vegetation, hydrodynamic, marsh edge geometric, and shoreline retreat data from various sources as well as to fill critical data gaps; and 3) to correlate the hydrodynamic forcing, soil shear strength, vegetation characteristics, soil biogeochemistry and marsh retreat rate, and develop a predictive model for marsh edge erosion of oiled wetlands for assessing the long-term impact of the oil spill on coastal wetlands in the northern Gulf of Mexico. We hypothesize that 1) coastal wetlands particularly in the marsh fringe zone negatively impacted by the oil spill reduce the shear strength of soil and vegetation or the resistance capacity against wave-induced erosion, 2) the accelerated, permanent marsh edge erosion reduces the sediment trapping capability of small marsh islands and increases wetland loss; and 3) the oiled-marsh edge retreat rate is controlled by the driving force of wave action, the resistance force of vegetation and soil, and erosion mechanism and progression. We will select four sites with oiled and non-oiled marsh edge along Barataria Bay for this study. We will 1) measure in situ salt marsh soil shear strength and other marsh soil geotechnical properties using field vane inspection tester and piezocone penetrometer; 2) measure belowground biomass and soil physical and ecological parameters such as organic matter and bulk density; 3) conduct detection of remotely sensed shoreline erosion rate and aboveground biomass (using Synthetic aperture radar (SAR) imagery) and then link to belowground biomass and soil strength to remote sensing derived aboveground biomass; 4) monitoring and modeling wave energy dissipation in shallow water systems and marsh morphological dynamics using coupled SWAN wave model and Delft3D morphology model; and 5) develop a wave-vegetation-soil-driven shoreline erosion model. The project outcomes will include improved consideration of wetland soil processes (i.e., relationship between marsh edge erosion, in situ soil shear strength, belowground biomass, soil organic matter, habitat types, plant cover, and clay-silt fraction) in predictive models, high-spatial resolution (~1 m) of marsh erosion and wave characteristics, and a more robust wetland morphology model that is incorporated in the Louisiana Master Plan modeling system. This will improve our ability to forecast the impact of coastal protection and restoration projects and assist in managing Louisiana's coastal resources. This project will directly tie to the NRDA Programmatic Damage Assessment and Restoration Plan (PDARP) and LA TIG responsibilities: "Goal: restore and conserve habitat. Restoration Types: wetlands, coastal, and nearshore habitats; habitat projects on federally managed lands".		$950,000
	Revision of the seagrass guidelines document: a support tool for restoration of seagrass impacts in the Gulf of Mexico	The 1998 seagrass guidelines document has emerged as a foundation reference guide for use by regulatory agencies and applicants in the Gulf of Mexico (GOM) and worldwide. Frequently, regulatory guidance is quoted directly from the document. As such, it is critically important to the successful management of the GOM seagrass resource that such a decision support tool provides the best science. However, this document is now significantly out of date (approaching 20 years), and a revision is required. Moreover, ~85% of the seagrasses in the conterminous U.S. lie within the waters of the GOM, making the need for updated information in the GOM especially pressing. Since 1998, over 2,000 seagrass-related papers have been published, with 366 reporting directly on seagrass restoration. Much of this work has fundamentally changed our understanding of seagrass biology and ecology and how seagrass restoration is approached. This information needs to be synthesized and unified with the previous guidance to provide an up-to-date and state-of-the-art seagrass restoration guidance document for the GOM. For the revision, emphasis will be placed on "how-to" guidance, including addressing frequently asked questions of policy, planning, methods, monitoring, and evaluation of success. This will be achieved by revising the 1998 document structure as well as through consultation with stakeholders, including practitioners and state and federal regulatory staff throughout the GOM region. Through that consultation, the addition of instructive case studies and call-outs highlighting instances of particular relevance will be provided throughout the text. Similarly, the document outline and content plan will be reviewed by key stakeholders. The core task is straightforward but also requires the most effort—namely reading, interpreting, and synthesizing the literature (both previous and new since 1998) and writing the revised document. Special assistance is requested for the genetics review. Notably, the lead author for the 1998 landmark publication is the lead author proposed here, and he has had extensive experience editing, reviewing, and writing peer reviewed publications related to seagrass restoration and ecology. He continues to be an expert and leader in the field of seagrass ecology and restoration. His role as the lead author provides this proposed revision with a unique level of practical experience and continuity. This project deliverable will meet standards of peer review and modern delivery avenues. Peer review will be conducted by soliciting reviews of limited sections of the document from professionals and experts in the field of seagrass restoration, both nationally and internationally. The final product will be made freely available from CSA's website and through appropriate government websites. Promulgation of the revised decision tool will also be made through direct engagement with regulatory personnel and the public, including training seminars. A diverse plan of social media utilization (magazines, Twitter, Facebook, websites) is also proposed.		$700,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Assessing the Ecological Connectivity of Gulf Environments	Assess the role of ecological connectivity in the Gulf including between the nearshore and offshore marine environments, for anadromous fish, and among coral reefs. and evaluate the role of nearshore habitats as nursery and foraging areas for offshore fish, water column invertebrates and turtles, of anadromous fish runs in the past and future Gulf ecosystems, and the relationships among coral reefs. a. Objectives: Identify the near-shore, freshwater, and coral reef environments that are most critical to protect and sustain populations of a variety of Gulf species that spend part or all of their life cycle in the open ocean. b. Species group/habitat: Fish, water column invertebrates and sea turtles. c. Description: It is critical to integrate the linkages between the near-shore, freshwater, and offshore environments in the design, development and monitoring of coastal and offshore habitat restoration investments. To do that studies should: i. identify and prioritize protected waters and nearshore environments (e.g., bays, estuaries, etc.) that contribute in maintaining populations of offshore endangered, commercial, and recreationally important species. This project should merge oceanographic and coastal biophysical, use and management information and develop a model of interactions (linkages) and produced scenarios to guide marine use and conservation planning. ii. Evaluate the potential for and impact of restoring anadromous fish runs in Gulf rivers including the potential for increasing the forage base for offshore fish. Historical accounts suggest that anadromous fish runs on Gulf rivers contributed significant amounts of forage fish to the overall Gulf ecosystem including for open ocean predators. This project has three parts: 1) Conduct historical research to verify the magnitude, location and species composition of anadromous fish runs in Gulf rivers, 2) Evaluate impediments to fish passage on Gulf tributaries with historically large fish runs and pr opose strategies for reducing or removing those impediments where cost-effective, 3) Propose other actions to restore historic populations of anadromous fish. iii. Study coral larvae connectivity. The objective of this study element is to understand the interdependence of important mesophotic and deep coral communities and their ecological connectivity for sustaining shallow water coral reef systems. The Gulf of Mexico is an important area for mesophotic and deep-sea coral communities, especially along the edge of the continental shelf (e.g., offshore banks). This project should assess the similarities, connectivity and threats to these communities in the northern Gulf. To do that it is necessary to: compile multiple sets of biophysical data for these areas, assess the ecological relationships among their species composition and with shallow water coral reef species, understand structural aspects of these communities using GIS modeling of benthic terrain, assess the ecological relationship of mesophotic coral species to shallow water coral species, and assess the importance of mesophotic and deep sea corals as essential fish habitat for commercially, recreationally and ecologically important species. Outcomes of this project should include indicators of diversity, structural complexity, threats and recommendations for their conservation.		$1,300,000
	Dock and Sea Wall Reef Ball® Habitat	Docks and seawall have historically been viewed a significant developmental impacts to the coastal environment. These areas generally have a lower overall species diversity and abundance of finfish, invertebrates, and aquatic plants when compared to surrounding natural areas. The general characteristics of seawalls is a high energy zone where water continually scours the bottom restricting natural community formation, while docks have been shown to dramatically reduce the available sunlight and increase sedimentation. These types of environments are not conducive to increasing natural community structures. The addition of Reef Ball® habitat to approved docks, piers, and seawalls not only provide physical protection in the event of seasonal storms but can increase the recruitment and survivability of juvenile finfish and invertebrate populations. These structures have also been shown to provide ideal settlement substrates bivalves, corals, and macroalgae increasing natural nutrient cycling and reducing turbidity. Cleaner less turbid waters have been correlated to increased species diversity and abundance worldwide and could constitute a significant step in the conversion of sterile manmade structures into a more natural living shoreline. Addition of these habitats could help mitigate shoreline development that would normally not be directly used by native finfish and invertebrates. Starting with Phase I, Reef Innovations would provide a crew to survey public docks and piers determine suitability for the individual areas for enhancement. The criteria for suitability will be developed in conjunction with the regulatory agency ensuring compliance with local, state and federal guidelines. Reef innovations will develop a site plan for each deployment based on the site criteria and deploy the units to maximize structural protection and species recruitment. The addition of the Reef Ball Habitat units will immediately reduce water flows through these areas and provid e settlement areas for the finfish and invertebrate community. The extent and makeup of the community will depend on the area. Phase 2, expands this program to private property owners following the criteria used for public docks and seawalls. These homeowners would finance their own projects thus saving the government money and giving the homeowners vested interest in marine conservation and restoration. Science has shown a need for increased restoration efforts in estuarine habitats. Shareholder involvement is a vital component to establishing a living shoreline and helps to create sustainability along our coastline through habitat restoration. Reef Innovations and/or their approved contractors can handle all parts of Phase I and Phase II activities. Funding requests grant will be based on size of project, distance of travel, cost of modules, used, and transportation of modules to the deployment site. Additional Information, Pictures and Pricing on within attached file updated Jan 2017. The project could be a small community project or combined as a large area wide project, in the packet it identifies a 10 year progression for the project.		$1,000,000
	Channel Marker Reef Ball Micro-Habitats	States, Counties and municipalities have channel markers they are responsible for maintaining under their USCG channel marker permit. Deployment of a Reef Ball® on each channel marker would provide increased micro habitat for finfish and invertebrate recruitment throughout the Gulf of Mexico. Production of Reef Balls is provided by Reef Innovations in Sarasota, FL. or the regional production sites (RPS) proposed for the area. This project can be run through the Reef Ball Foundation which is a 501(c) 3 publicly supported nonprofit and international environmental NGO working to rehabilitate marine reefs. This has proven beneficial where nonprofit organization involvement is desirable. The Reef Ball Foundation's mission is to rehabilitate our world's ocean reef ecosystems and to protect our natural reef systems using Reef Ball artificial reef technologies. A proposal has been submitted for funds to set up "Reef Ball Production Sites" in the Panhandle and Big Bend regions in Florida as well as proposals for sites in Texas and Mississippi. This would reduce the cost of deliver modules to the various projects in the region and reduce the cost per microhabitat unit. For this project, a crew of 3 workers could work their way across the state or region installing the micro habitats over a period of 3 to 10 years, or the units and deployment training could be supplied to the individual county for implementation. Reef Innovations would provide the product and quality control of the project. Local port authority could provide the labor with a crew normally installing markers. Reef Innovations could provide a foreman to work with locally hired crews. Reef Modules used depend upon the water depth, piling diameter and relief desired. As you move toward deeper water its is suggested to increase the size Reef Ball. Monitoring During the initial survey, objectives will be established for the microhabitat including expected species recruitment. Initial Surv ey Reef Innovations Government Organization … Permitting Follow up Survey Reef Innovations has the right to make a full survey yearly, or an approved researcher appointed by Reef Innovations Government organization will provide survey reports to Reef Innovations on a yearly basis. Government organization will provide a 10 year survey report, and summary of project. A database of locations and observations will be established for the monitoring of the project results. Presentations will be prepared for at conferences at the 5 and 10 year point. There are three protocols for placing the units: 1. Unit incorporation during marker replacement as part of the regular maintenance 2. Lowering the Reef Ball over an existing channel marker piling 3. Placing a two piece unit around the piling of an existing marker Environmental Benefits Reef Balls have a proven track record for providing habitat for juvenile finfish and invertebrate recruitment. These units located along deep water channels will provide increased habitat for the movement of both finfish and invertebrates species in and out of coastal estuaries. They also provide increased settlement substrate for sessile oysters, corals and macroalgae. A supplemental document is available breaking down the costs and identifying the process. Contact Larry Beggs for that document Larry@reefinnovations.com The project can be implemented locally, the cost projection on this description is a yearly cost for 10 years, across multiple regions of the Gulf.		$613,500

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Reef Innovations Reef Ball regional Production Sites	Restore Act's has created a wide area multi county combination of projects that are: restoring coastal habitat, creating oysters or restoring oysters, creating new snorkeling reefs, improving coastal living shoreline and adding deep water habitats along the coast of the Gulf of Mexico. Many projects have been proposed to deploy artificial reef modules with various objectives, rather than each community, county or non-profit organization having to work out a purchasing agreement this project would provide local jobs building the Reef Ball modules for deployment. The Reef Ball Regional Production Site is designed, to create local jobs, and reduce the overall cost of production and delivery of reef modules thus becoming more cost efficient. Rather than numerous projects having to handle the purchases of product, they would be allotted a portion of the production from the RPS. If production exceeds the immediate demand, product would be stockpiled for distribution over the next several years. This project provides employment for 4 to 6 local laborers over 3 to 10 years, and provide a continuous supply of reef modules to be used by the 24 impacted counties in Florida. Depending on the quantity of product that is needed, state funds from the 5 States could support production at additional Reef Ball Regional Production sites, thus reducing the delivery cost even more. Reef Innovations has years of experience setting up worldwide remote production sites. Reef Innovations would be responsible for setting up, and the quality control of Reef Ball production site using local labor. Funds drawn from the grant would be the amount of the sales price of the actual number of modules produced during that week. Reef Innovations would contract from a labor force of local workers. Reef Innovations would set up and manage the production site. Monitoring Projects supplied with Reef Balls will be monitored recording items such as site location objectives. Verification of deployment site, numbers of units and objectives. 1. All sites using Reef Balls are expected to provide monitoring. A link to Monthly summaries by the organization in charge of the project will be made available during the first year and a yearly survey summary provided for the next 5 years. 2. Reef Innovations will maintain the right to monitor on a yearly basis or have it monitored by their designee. Results of the monitoring of each project site will be compiled for presentations at the 5 and 10 year mark. 3. A database will be established to be available for research and evaluation. Technical Feasibility 1. Building Reef Balls close to the deployment site can reduce the unit cost when projects are using large quantities of Reef Balls. 2. This is the most feasibly way to provide Reef Ball modules to various areas around the 5 Gulf State. 3. By stockpiling the modules for distribution to approved environmental groups, county Artificial Reef, and Breakwater projects this can become an ongoing project lasting many years. Production Sites and Use of Reef Balls will 1. make the communities a better place to live and help to restore the health of the Gulf of Mexico. 2. add local ownership to the projects 3. allow ecosystem services to obtain materials as projects are placed on the table Creation and preservation of jobs because of the Reef Ball Production Site 1. 4 - 6 local labor workers per site and a Reef Innovations foreman for quality control. 2. Increased work for a Concrete Company, Drivers and support personnel 3. The community economic benefits will include house rental, grocery stores, restaurants, barge and boat operators, etc. 4. Product from the site will benefit fishing, as well as in some projects adding resilience to shoreline, or increasing relief for oyster restoration projects. Supplemental materials are available by contacting Larry Beggs Larry@reefinnovations.com		$3,340,000
	Pelagic Longline Gear and Vessel Transition Program in the Gulf of Mexico	The Gulf of Mexico is the primary spawning ground of the western Atlantic bluefin tuna population, a stock depleted to just 55 percent of the 1970 level. The oil spill occurred at the peak of the 2010 spawning season in the bluefin's northeastern Gulf spawning hotspot. Scientists estimate that the spill degraded 10 to 50 percent or more of the bluefin's known Gulf of Mexico habitat and further study has since confirmed that the spill damaged Atlantic bluefin tuna health, particularly among the early life history stages. The Gulf of Mexico pelagic longline fishery results in harmful bycatch of bluefin tuna and approximately 80 other species, including billfish, endangered sea turtles, and depleted sharks. Government catch data from 2007-2009 indicates the fishery killed 43,245 non-target animals, including 6,009 lancetfish, 5,844 dolphinfish, 2,747 escolar, 1,745 sharks and rays, 858 wahoo, 794 billfish (marlin, sailfish, spearfish), 612 bluefin, and 169 bigeye tuna, and interacted with 137 leatherback and 17 loggerhead sea turtles. Actual mortality is much greater as only an average of 22% of the hooks set were observed. Based on their shared habitat preferences with bluefin tuna, it is possible that many of these species also suffered similar interactions with and injury from the spill. A voluntary pelagic longline gear and vessel transition program can help mitigate such impacts to the benefit of Gulf fishermen. The program will provide fishermen with selective alternatives to PLL, including green stick gear and swordfish buoy gear, as well as training and financial assistance to help them learn to fish and optimize application of these gears in the Gulf of Mexico. Fishermen would also have the opportunity to retire their current PLL fishing vessels in favor of smaller, more fuel efficient boats more appropriate for use with the alternative gears. These efforts would be complemented by a strong monitoring program to record catch, effort, and economic data, an d, ultimately, to measure the benefits of this project over time. This concept enjoys broad support from PLL fishermen, recreational anglers, and environmentalists. Project Cost: The cost of the project depends on how many Gulf of Mexico pelagic longline fishermen participate. The cost of a gear transition is undetermined at this time. The estimated cost for a vessel transition is approximately $450,000 to $550,000 per vessel.		
	Open water restoration for nesting fisheries, water birds, and foraging waterfowl	Construct a dedicated dredge fill of open water lands on private lands west of Lake Rd with possible terrace inclusion. Plant marsh grasses in new fill area and on terraces. Interior ponding and, to a lesser extent shoreline erosion, are the major causes of wetland loss in the project area. From 1974 to 1990 marsh loss rates averaged approximately 35 acres/year. Those high loss rates are associated with hydrologic alterations which allowed saltwater to penetrate the fresher marshes. In addition, the passage of Hurricane Katrina also contributed to the loss of as much as 3.6 square miles of wetlands within the project area. During the transition to a more brackish plant community coupled with the storm events of 2005, large ponds have formed. A narrow strip of land separates those ponds from Lake Pontchartrain. Although the shoreline erosion rates are relatively low, the shoreline is already breached in several areas, and marsh loss in the interior ponds is expected to increase as the shoreline is breached. The primary goal is to re-create marsh habitat in the open water areas and nourish adjacent deteriorating marsh. This project will afford the communities along the north shore, such as Lacombe, storm surge protection. The project size could be scaled differently if needed. Borrow material might be taken from Lake Pontchartrain. The area can support a large number of wintering waterfowl, including horned grebe and common loon, various gulls, terns, herons, egrets, and rails. The area has been designated as an Important Bird Area by the American Bird Conservancy. Restoring these marshes in private lands within Big Branch Marsh NWR along the north shore will help to protect fish and wildlife trust resources dependent on marsh habitats, particularly at-risk species such as the diamondback terrapin, black rail, reddish egret, brown pelican and the Louisiana eyed silkmoth; and migratory waterfowl which are dependent on those marsh habitats. Containme nt dikes would be constructed to achieve target elevations. Up to 16 million cubic yards could b used in the area to create marsh habitat to fill a target elevation of 1.4 feet NAVD88.	St. Tammany Parish	$21,000,000
	Close-kin Mark Recapture as a Tool for Estimation of Spawning Biomass in the Gulf of Mexico Bluefin Tuna Population	The western Atlantic bluefin tuna (WBFT) population sustained injuries from the Deepwater Horizon (DWH) oil spill since the Gulf of Mexico is its only major spawning ground and the spill occurred in one of the spawning hotspots during the peak spawning season. The DWH Damage Assessment estimated that billions of bluefin larvae were killed, in part due to documented cardiotoxicity, with injury up to 4 million kg for large tunas. As part of the restoration plan, adaptive management has been prioritized, including collection of fishery-independent data to better understand status and trends. Close-kin mark recapture (CKMR) is a new method which uses next generation genetic techniques to match parents and offspring to estimate spawning abundance in situations where traditional assessment methodologies are highly uncertain. This is certainly the case for WBFT. The method proceeds as follows: randomly sample juveniles and adults, use next-generation sequencing to obtain a unique genetic signature for each parent and each juvenile, and count the number of matches, or Parent–Offspring Pairs (POPs). Traditional mark-recapture population estimation methods then can estimate the number of adults in the population. Fewer POPs indicates a larger spawning population. By repeating the sampling over several years, one can obtain an updated abundance estimate, greatly improve the precision of the population estimate and estimate survival of parents when their progeny are identified over multiple years. To deal with sampling complexities in cases like WBFT, it is also necessary to look for Half-Sibling Pairs among juvenile samples. A pilot project is underway to collect samples of larval, juvenile, and adult WBFT to determine the best approaches for sample collection and genetic analyses. In this study, we propose to collect the remaining number of required samples (estimated at 1500 young and 1500 adults) and conduct the full CKMR by using modern reduced-representation high-thro ughput genotyping methods to count the number of POPs. This information will give us an accurate count of the number of individual adult WBFT for the first time, helping scientists and managers to determine how to successfully rebuild this depleted population, which sustained further injury from the DWH spill. The CKMR results will be incorporated in the management strategy evaluation being developed by an international team to design a more effective and efficient harvest strategy that will benefit both the stock and fishery, commercial and recreational alike. This approach has already been applied for southern bluefin tuna and is in progress for Pacific bluefin tuna.		$350,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Little Lagoon Multiple Site Living Shoreline Restoration	Living shoreline quantity and quality in Little Lagoon has been severely impacted by ever increasing population density and property modifications such as bulkheads and piers. Coastal expert Scott Douglas has estimated over 50% of Little Lagoon has a hardened shoreline. Of the remaining 50% of Little Lagoon that remains unhardened, 2/3 can be found within the boundary of Bon Secour National Wildlife Refuge (BSNWR). Ultimately, the Lagoon is showing signs of stress due to the reduction of natural shorelines, inadequate flushing, high bacteria levels in parts of the Lagoon, and increasingly frequent and dense harmful algal blooms (HABs) throughout the Lagoon. Nutrient sources are significant and should be remediated. Flushing is part of the solution but another is nutrient removal via natural vegetation and filter feeders, such as mussels, that can both be found in functioning living shorelines. Shoreline loss/erosion is another chronic issue for properties along the Lagoon. Although efforts to keep oil out of the Lagoon during the Deepwater Horizon (DWH) oil spill were successful, some unintended consequences were noted. Heavy rain fall during the latter part of the multiple pass closure period resulted in high water and infrastructure damage (sea walls/bulkheads, piers, roads, etc.). An opportunity exists to improve water quality in the lagoon, return shorelines to a natural state, repair roads/shorelines and "showcase" methods to improve the health of the Lagoon and remediate problems. Little Lagoon Preservation Society, the City of Gulf Shores, and the BSNWR would like to work in partnership to conduct several shoreline restoration projects: 1) restore .3 miles of shoreline along the south west corner and the south shore of the Lagoon within the BSNWR and on State owned water bottom. Pine Beach Road is nearly in the water along that potion of the Lagoon due to shoreline erosion and few viable options exist to move/repair the road due to adjacent Alabama beach m ouse and wetland habitats. Pine stumps and degraded shoreline vegetation in the water and along that waterfront are ample evidence of eroding shoreline. Restoration would include a combination of evaluation, planning and implementation of a living shoreline project. The specifics of the living shoreline project would be finalized during the evaluation and planning process. However, the living shoreline restoration project is likely to include, but is not limited to, shoreline grass planting (Spartina alterniflora and Juncus roemerianus), wave attenuation structure (reef balls), a graded bottom slope, and possibly mussel seeding in the shoreline grasses. 2) Construct a living shoreline at the City of Gulf Shores property at Moe's Landing Boat Launch. The water front there also is severely eroded and parts of it are hardened with deteriorating bulkheads. The same or a similar restoration method would be used at the Moe's Landing Boat Launch site. Both the Moe's Landing and BSNWR sites would provide very visible "showcases" of natural shoreline restoration for the public and could be a catalyst for future return of more hardened shorelines in the Lagoon to a natural state.		$950,000
	Presence, Potential Sources, Behavior and Fate of Endocrine Disrupting Chemicals in Northern Gulf of Mexico Estuarine Systems	This project will conduct the first detailed sediment, surface water, suspended organic matter, and sediment pore water assessment of northern Gulf of Mexico estuarine systems to identify the presence, potential sources, and physicochemical mechanisms controlling the behavior and fate of complex mixtures of known or suspected endocrine disrupting chemicals (EDCs) in these systems. EDCs are natural or synthetic compounds which, even at trace exposure levels, can alter early development in vertebrates and invertebrates and cause serious effects later in life or even in successive generations. Known or suspected EDCs include many compounds used in or produced during oil and gas exploration/production; some of the more recalcitrant compounds associated with raw crude oil are known/suspected EDCs. EDCs can easily pass into ecological systems and are often persistent; moreover, the consequences of exposure are markedly different from how we usually think of exposure to environmental contaminants. At the levels found in natural systems, EDCs do not destroy cells or attack DNA. Rather, they target a developing organism's chemical messengers (hormones) and the messaging network (endocrine system). Organisms living in estuaries are particularly vulnerable to the effects of EDCs, mainly because estuaries are natural sinks for contaminants transitioning from terrestrial to marine ecosystems. Estuaries are among the most productive biomes on earth; nearly 50% of the world's population lives or works in close proximity to estuaries. Consequently, estuaries are under increasing threat from both natural and anthropogenic stressors (including EDCs). Little is known about the types, behavior, and ultimate fate of the vast number of potential EDCs entering estuaries, although it is known that some EDCs are present in these systems and that some estuarine organisms show signs of EDC exposure. Very few field-based studies have considered EDC behavior and fate in estuaries. Of these, most have considered a limited number of sampling locations, a single sampling event, or both. Moreover, most did not consider mixtures of EDCs likely to be encountered in estuaries, nor were their methods of chemical analysis capable of detecting or quantifying EDCs at trace levels. Also, none considered sediment pore water as a partitioning phase, and none attempted to quantitatively link EDC partitioning behavior to spatiotemporal distributions of multiple EDCs within real estuarine systems. The proposed project will significantly advance our abilities to detect and quantitate mixtures of EDCs at trace concentrations in complex estuarine samples and will provide the first quantitative mechanistic evidence linking the behavior of EDC mixtures (transport and partitioning) to their fate (spatiotemporal accumulation, sequestration, and resuspension) as a function of dynamic estuary system conditions (hydrodynamics, water quality parameters, physicochemical conditions of partitioning phases). The results of this project will provide the first detailed, data-driven assessment of the scope of EDC contamination in northern Gulf of Mexico estuarine systems, provide a basis for examining ecological and human risks posed by EDCs in these ecosystems, and inform potential restoration actions to address these risks.		$2,000,000
	Understanding the use of Fish Aggregating Devices to enhance the conservation of tunas and protected species	The Gulf of Mexico and Atlantic Ocean provide habitat for protected species such as sharks and the commercially and ecologically important species of bigeye and yellowfin tunas. Fish aggregating devices (FADs) are man-made floating objects consisting of a raft, synthetic netting, and plastic buoy that are deployed on the ocean to aggregate skipjack tuna for purse seine fishing vessels. FADs can be used in unlimited numbers, driving unsustainable fishing of juvenile bigeye and yellowfin tunas and contributing to fishing mortality on sharks. These species are caught incidentally when purse seine nets are set around FADs. Because most FADs are not recovered by fishing vessels, they contribute to ghost fishing and can entangle sea turtles and marine mammals before sinking in the ocean or washing ashore, adding to marine debris. FADs deployed by vessels in the Atlantic have been found washed ashore on the coast of Gulf States including Texas. This project would enable data to be gathered electronically on FADs deployed in commercial tuna fisheries in the Atlantic. FADs already transmit data to industry that indicates the numbers of FADs used, their locations and movement, and their fate (recovered, beached, and/or lost). The project partners, Pew and Quick Access Computing (QAC), have proven this data can be transmitted to a third party in near real-time and at no additional cost to industry. In 2016, eight countries in the Western and Central Pacific Ocean began using a software system designed by QAC to implement a FAD tracking and data collection effort that is generating new knowledge on the use of thousands of FADs in that region. In the Atlantic, precise information on FADs is not required to be reported to the international fishing management body. Data gathered by this project will improve scientific understanding on the effects of FADs on the marine ecosystem in the Atlantic, where bigeye is overfished and experiencing overfishing. Analysis of the data could lead to more effective conservation for tunas and protected species, which could improve their recovery from the Gulf oil spill. Studies showed juvenile yellowfin exposed to oil developed heart defects; other species such as dolphins developed chronic adrenal gland and lung disease. QAC, a respected Australia-based software organization, will develop software to receive and manage data from FADs in the Atlantic and manuals for the system. Pew will work with international fishery managers, industry, and scientists to build the institutional arrangements to enable the system to benefit science and management. (A brief description of the proof of concept to create a FAD tracking and data gathering system in the Pacific can be viewed at http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2014/09/electronic-tracking-of-fish-aggregating-devices)		$400,000
	Barataria Bay Rim Shoreline Protection	This project is to protect shoreline with 740-Geo-TECH-Jetti's Units. The project is a nominee PPL24 with CWPPRA, to create 232 acres of marsh with dredge material. The South shoreline is open to wide open water and should be protected with a barrier. We propose to install 740 Geo-TECH-Jetti Units above the water line, (as determined by official government determinations) Our Geo-TECH-Jetti units are filled with dredged material sourced from near the installation. Within a prepared area on top of the Geo-tech containers are Root-Zone Humus-filled, (RZHO), biodegradable containers. The RZHO-filled containers are planted with mature native marsh grasses and other select native plants. Our specialized method, proven in several previous deployments, ensures highly energetic and sustained plant growth, while providing shoreline force protection. Our proven methods allow for replacement of rock as stabilization means. Using our proven methods, we ensure rapid reestablishment of habitat. Shellfish, fin-fishes, invertebrates, and other vital coastal organisms are able to reestablish populations. Installing our Geo-TECH-Jetti units, we accomplish rapid rebuilding of the entire food-web, by providing the multiple benefits. (1) We can provide protection from sea-rise. (2) We ensure rapid establishment of native plants along shorelines, making possible rapid habitat establishment. (3) Our methods assure accretion, as the long, well-set units of Geo-TECH-Jetti prevent erosion. (4) The Geo-TECH-Jetties also provide protection from surface and sub-surface oil encroachment on shorelines and into adjacent marshes. (5) Shoreline areas of land, (marshes or barrier island shores), behind the rows of Geo-TECH-Jetti units are filled with dredged material has our process continues, the filled RZH and RZHO are applied to ensure fertility. The Geo-TECH-Jetti is set in place from barges. Trident plans to hire all local personnel for project.	Plaquemines Parish	$1,556,400

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	West Whiskey Island Shoeline Protection	Install 1,548 Geo-TECH-Jetti Units above the water line, (as determined by official government determinations) Our Geo-TECH-Jetti units are filled with dredged material sourced from near the installation. Within a prepared area on top of the Geo-tech containers are Root-Zone Humus-filled, (RZHO), biodegradable containers. The RZHO-filled containers are planted with mature native marsh grasses and other select native plants. Our specialized method, proven in several previous deployments, ensures highly energetic and sustained plant growth, while providing shoreline force and sea-rise protection. Once set in place the Geo-TECH-Jetti units are stabilized with XX heavy duty PVC pipe, driven down 7 feet for firm hold, there are stainless steel rings on the bottom of units in three locations for PVC pass through. The PVC stabilization devices are designed so that they can be retrieved at a future time, when it may be determined that plant rooting and accretion has been achieved and our "hold" feature is no longer needed. Our proven methods allow for replacement of rock as stabilization means. Using our proven methods, we ensure rapid reestablishment of habitat. Shellfish, fin-fishes, invertebrates, and other vital coastal organisms are able to reestablish populations. Installing our Geo-TECH-Jetti units, we accomplish rapid rebuilding of the entire food-web, by providing the multiple benefits. (1) We provide protection from sea-rise. (2) We ensure rapid establishment of native plants along shorelines, making possible rapid habitat establishment. (3) Our methods assure accretion, as the long, well-set units of Geo-TECH-Jetti prevent erosion. (4) The Geo-TECH-Jetties also provide protection from surface and sub-surface oil encroachment on shorelines and into adjacent marshes. (5) Shoreline areas of land, (marshes or barrier island shores), behind the rows of Geo-TECH-Jetti units are filled with dredged material has our process continues, the filled RZH and RZHO are applied to ensure fertility. The Geo-TECH-Jetti is set in place from barges. Our Geo-TECH-Jetti Placement System makes it possible for us to position units efficiently, one in front of the other, and over lapping with space between them allowing existing habitat to continue functions as installation is accomplished. If it is decided that marsh or shoreline is not to be filled in some areas where Geo-TECH-Jetties are being installed, our units are set next to each other and can be used to serve as solid shoreline protection without back-filling.		
	Goose Bay Shore lin protection	Restore the west bank above 'The Pen' south of Hwy 90 with Bayou Backer. All areas which are not suited to rock or hard heavy methods are now approachable. Ten to fourteen foot by six inch wide strips of 40 mil plastic are pulled from a roll, folded in half and shoved into the mud bottom 1.5 to 2.5 feet deep in to the mud. This leaves two 6 inch wide by 3 to 4 foot long 'blades' sticking up from the bottom and forms a 'plug'. The plugs are spaced 2 feet apart in swaths 16' to 24' wide eight to twenty feet from shore running the full distance. The plugs provide up to 60% wave energy damping, catch sediments and aquatic plants. The plants enhance shore protection and build up habitat. Cost, simplicity and effectiveness are the primary advantage for using Bayou Backer. I have an LSU wave tank study, a couple of test sites and a new State Coastal Use Permit for Little Vermilion Bay terraces.	Jefferson	$675,000
	Goose Bayou	Restore the west bank above 'The Pen' south of Hwy 90 with Bayou Backer. All areas which are not suited to rock or any hard, heavy and costly methods are now approachable. Long strips of 40 mil plastic are shoved into the mud bottom 1.5 to 2 feet deep. This leaves two 6 inch wide by 3 to 4 foot long 'blades sticking up from the bottom. Placed 2 foot apart the collective 'plugs' damp waves, catch sediments and aquatic plants. These plants can begin to take root and build up habitat. Cost, simplicity and effectiveness are the primary advantage for using Bayou Backer. Please go yo my website for pictures and history! Thanks. Joe		$650,000
	Bay Dogris Marsh Creation	Historic wetland loss in the area occurs in the form of interior marsh loss and shoreline erosion along Turtle Bay and Little Lake. The interior loss is caused by subsidence, sediment deprivation, and construction of access and pipeline canals. The Little Lake Coast 2050 mapping unit land loss rate for the period of 1983 to 1990 was 1.6% per year. The proposed project would create approximately 213 acres and nourish approximately 441 acres of marsh using sediment dredged from Little Lake. The dredged material would be fully contained. Containment dikes will be degraded as necessary to reestablish hydrologic connectivity with adjacent wetlands. In case the area does not re-vegetate on its own, the maintenance cost estimate will include funds to plant 25% of the created marsh at Year 3. The anticipated land loss rate reduction through the area of direct benefits of the project totals over 50% over the life of the project. The project would help to stabilize the very fragmented and vulnerable land mass that separates Barataria Bay from Little Lake. The communities of Lafitte and Barataria lie to the north of this important landmass, which provides a buffer to these communities against the impacts of surge from tropical weather events. Vital oil & gas infrastructure would also benefit from the reduced land loss in the area.	Jefferson Parish	$18,300,000
	Barataria Bay Rim Marsh Creation	Historic wetland loss in the area occurs in the form of shoreline erosion along Barataria Bay and interior marsh loss. The interior loss is caused by subsidence, sediment deprivation, and construction of access and pipeline canals. Based on analysis conducted by USGS, loss rates in the area are estimated to be -0.615% per year for the period 1984 to 2011. Shoreline erosion along the northeast shore of Barataria Bay, in the area proposed to be addressed by this project, is approximately 3 to 4 feet per year. While this rate may not seem excessive, this reach of shoreline is very narrow and loss of this shoreline would connect Barataria Bay to a large lagoon, greatly altering the hydrology of the marsh. The proposed project would create approximately 232 acres and nourish approximately 322 acres of marsh using sediment dredged from Barataria Bay. The dredged material would be fully contained. Containment dikes will be degraded as necessary to reestablish hydrologic connectivity with adjacent wetlands. In case the area does not re-vegetate on its own, the maintenance cost estimate will include funds to plant 25% of the created marsh at Year 3. The anticipated land loss rate reduction through the area of direct benefits of the project totals over 50% over the life of the project. The project would help to stabilize the very fragmented and vulnerable northern rim of Barataria Bay. The communities of Lafitte and Barataria lie to the north of this important landmass, which provides a buffer to these communities against the impacts of surge from tropical weather events. Vital oil & gas infrastructure would also benefit from the reduced land loss in the area.	Plaquemines Parish	$14,200,000
	Grand Pierre Island Restoration	This area is undergoing shoreline erosion, interior wetland loss, overwash, and breakup. The Gulf shoreline erosion rate has doubled from 1988 to 2006. Project area marshes also are being eroded at -11.8 ft/yr between 2003 to 2006 as well as being converted to open water from internal breakup. This project is the missing link in restoring the 14 mile barrier island complex. This project was initially brought forward as a potential project for CWPPRA PPL24. The project would restore 127 acres of beaches and dunes and create/nourish 229 acres of marsh. The project would use existing near-shore borrow areas, with a projected need of 1.45 million cubic yards. The purpose of the Project is to restore the missing link in the barrier island complex by restoring 127 acres of beaches and dunes and nourishing/creating 229 acres of marsh. The completion of this project would complete the restoration of nearly 14 miles of barrier islands in the Gulf which protect the rest of the Barataria Basin as a first line of defense for storm surge. The project will reduce the impacts of storm events on the Barataria Basin. Grand Pierre Island also provides important habitat for nesting shorebirds as well as migratory birds.	Plaquemines Parish	$18,600,000
	Caminada Headlands Back Barrier Marsh Creation - 2	The Caminada headland has experienced some of the highest shoreline retreat rates in Louisiana, measuring between 55 and 65 feet per year from 1998 to 2010 (historically, up to 100 feet per year). At the same time, the area is also experiencing extremely high loss rates of interior marshes. As the barrier headland continues to retreat, overwashed sediment will be lost into newly formed open water and these land loss rates will be exacerbated. The project would create 257 acres and nourish 256 acres of emergent marsh using sediment form an offshore borrow site. This material would be placed behind approximately 4 miles of Caminada beach as the front containment, while using as much of the existing pipe canal levees and healthy mangrove marsh as feasible for containment. In areas where the use of the existing marsh is not possible, other tactics may be employed, such as the use of hay bales or a sheet pile. Where open water exists over longer distances along the proposed containment, borrow from the outside of the cell may be used. Total constructed containment (including earthen, hay bales, and sheet pile) will total 7,411 feet. Vegetative planting will occur on 50% of the project area. The marsh created will serve as a platform for the overwashed beach sediment to fall back against, rather than losing the sediment to open water.	Lafourche Parish	$20,900,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Caminada Headlands Back Barrier Marsh Creation - 1 (BA-171)	The Caminada Headland has experienced some of the highest shoreline retreat rates in Louisiana. Historically the shoreline has migrated landward at about 40 feet per year. Between 2006 and 2011, shoreline migration increased dramatically, exceeding 80 feet per year in near Bay Champagne and 110 feet per year in the Bayou Moreau area. The increased losses occurred in the wake of Hurricanes Katrina and Rita in 2005 as the breaches remained open for an extended length of time. The losses were exacerbated by Tropical Storm Fay and Hurricanes Gustav and Ike in 2008. Significant prolonged breaches greatly increase the net export of sediment from the headland. In addition to the shoreline migration, the area is also experiencing high loss rates of interior marshes. As the beach and dune continue to migrate landward, overwashed sediment will be lost into newly formed open water and land loss rates will be exacerbated. The continued deterioration of Caminada headland threatens thousands of acres of wetland habitat as well as critical infrastructure, including Port Fourchon, LA Highway 1, and the lower Lafourche levee system. The goals of this project are to: 1) Create and/or nourish 430 acres of back barrier marsh, by pumping sediment from an offshore borrow site; 2) Create a platform upon which the beach and dune can migrate, reducing the likelihood of breaching, improving the longevity of the barrier shoreline, and protecting wetlands and infrastructure to the north and west. The proposed project is expected to slow the current trend of degradation in the headland. This project would create 300 acres of back barrier inter-tidal marsh and nourish 130 acres of emergent marsh behind 3.5 miles of the Caminada beach using material dredged from the Gulf of Mexico. The marsh creation and nourishment cells are designed to minimize impacts on existing marsh and mangroves. Assuming some natural vegetative recruitment, vegetative plantings are planned at 50% density, with half pla nned at project year one and half planned at project year 3. Containment dikes will be degraded or gapped by year three to allow access for estuarine organisms.	Lafourche Parish	$31,000,000
	Elmer's Island Restoration	As part of an erosional headland, Elmer's Island is dominated by marine processes including overwash. The island has narrowed and decreased in elevation escalating the rate of overwash and breaching near the confluence with the headland as well as along Caminada Pass. As the island has become more vulnerable from overwash and breaching, island habitat has been lost and protection of mainland marsh and infrastructure has diminished. Sand fencing efforts are helping portions of the island maintain hummocky dunes. Extension of the spit into Camanida Pass and periodic closures of Bayou Thunder von Tranc at the Gulf (and siltation throughout) is altering the hydrologic connection of the lagoon and marshes north of Elmer's island. The spit along the pass is breached. Although sediment transport will continue across the breach supporting extension of the spit towards Caminada Bay, the breach is likely to persist and worsen without corrective actions. The 1985 to 2009 Port Fourchon subunit loss rate is -0.49% per year. The proposed project goals are: 1) habitat, 2) hydrology, and 3) protection. The proposed features include approximately 26 acres of spot dune repair at sites where overwash and breaching is reoccurring; breach closure, and 300 acres of back barrier marsh creation. Sediment for marsh creation would be mined offshore of the headland at a distance to avoid inducing shoreline erosion. Sand is necessary for the spot dune repair and the breach closure. Mining the newly developing portions of the spit may be targeted. If so, spit habitat losses are expected to be temporary as re-growth is expected over time. Maintenance dredging of Bayou Thunder (if adequate sand content) and offshore mining (if sand is available without infrastructure constraints) also would be considered as alternative sources for dune construction material. Mining of the spit may temporarily re-establish historic hydrology as could dredging the bayou. The spot dune repair and bre ach closure would be planted with dune vegetation and the marsh platform would be planted with marsh vegetation. Various design alternatives will be considered for the breach closure. A rock core with sand capping tentatively is assumed. Consideration will be given to directly or indirectly create tidal flats to replace those that exist now, but would be filled with the dune and marsh restoration.	Jefferson Parish	$26,200,000
	A way to clean some of oil out of the gulf	fisherman catch tar ball in there nets .they rake this tar balls back into water .So instead of them raking the tar ball back into water give them some kind of storage container to put the tar balls in .to give them an incentive to do this pay them by the pound or container .This how we feel some of oil can be removed from gulf .		
	Fifi Island Rock and Restoration Project	The project is located adjacent to Bayou Rigaud, on the northern side of Grand Isle in Jefferson Parish, Louisiana. The long-term goal for the restoration of Fifi Island is to restore maritime forest and wetlands as features of the island. Given the extensive erosion caused by hurricanes, storm surges, frontal passages, and other natural sources the actual land mass of Fifi Island has significantly decreased over many years. In order to restore Fifi Island, the Grand Isle Independent Levee District (GIILD) has developed a Master Plan, which includes the installation of rock dike on the southern side of Fifi Island to completely encompass the island, and later fill the encompassed area, utilizing dredged material from Bayou Rigaud and Barataria Bay, in a manner to create wetlands and a maritime forest as features of the island. The full rock dike project includes approximately 5,975 lineal feet of rock dike to be constructed to +8 feet, in addition to 1,400 lineal feet of existing rock dike to be improved to +8 feet. In 2014, the GIILD, Jefferson Parish and the State of Louisiana allocated $6.0 M for Phase 1 of the rock armament on the south side of FiFi Island. This Phase is now under construction and consists of the construction of approximately 3,400 lineal feet of new rock dike beginning at the western terminus of the existing rock dike and extending in a westerly direction along the permitted alignment. The second phase of this project is permitted and awaiting funding to proceed to construction. When completed FiFi Island will be armored on all 4 sides with rocks revetment and will be built up to +8.0' elevation on the South side and 3.5' elevation on the North side using "beneficial use" dredge material or dedicated dredging from Bayou Rigaud and the Barataria Bay Waterway. This project has a high level of local support from stakeholders such as the Town of Grand Isle, Grand Isle Port Commission, Jefferson Parish Marine Fisheries Advisory Board, Jefferson P arish Coastal Stakeholders Group and residents of Grand Isle.	Jefferson Parish	$35,000,000
	West Grand Terre Beach Norishment and Stabilization	The objectives of the proposed West Grand Terre Beach Nourishment and Stabilization project are to restore and enhance dune and back barrier marsh habitat to provide storm surge and wave attenuation, thereby addressing the issues of gulf shoreline erosion, diminished storm surge protection, and subsidence of back barrier marshes. This project is estimated to build 12,700 feet of beach and dune with an area of 235 acres. In addition, up to 66 acres of back barrier marsh will be restored and a rock revetment will be constructed to protect the restored marsh. The project will increase the width of the island and maintain shoreline integrity through the introduction of sediment in order to increase island longevity. The project will promote community resilience and reduce risk to infrastructure by providing storm surge and wave attenuation and will protect and restore nesting and migratory bird habitat, including wintering habitat of the endangered piping plover (Charadrius melodus, Haig and Oring 1985). Restoration of West Grand Terre will also protect Fort Livingston, which was constructed in 1841 and is listed on the National Register of Historic Places. West Grand Terre is also recognized as a State Commemorative Area and will protect Grand Isle, the only inhabited barrier island in Louisiana.	Jefferson Parish	$65,000,694
	Mississippi River Long Distance Sediment Pipeline Phase II	This project is a westward extension of a successful project to construct a long-distance pipeline corridor for conveying Mississippi River sediments for land building (marsh and ridge) to strategic areas of the central Barataria Basin. The LDSP project from the Mississippi River to Lafourche parish north of Little Lake was included in the Future Without Action for Louisiana's Coastal Master Plan as it was an existing CIAP project. However, funding constraints limited construction to only the eastern segment. Phase I of the project, to construct the corridor from the Mississippi River westward to the Barataria Waterway, is currently under construction with funding being contributed from the State of Louisiana and three coastal parishes, Jefferson, Lafourche and Plaquemines. Funding of the LDSP Phase II project, which would continue westward construction of the corridor from the Barataria Waterway into Lafourche Parish, is needed to complete the pipeline corridor. Completion of the LDSP project would advance hydrologic restoration in the central Barataria basin, as it would help to replace the historic function of the Barataria landbridge and the Barataria ridge, which was severed by construction of the Barataria Bay Waterway. This project is major component of restoration of the Barataria landbridge, which separated the freshwater dominated upper portion of the Barataria Basin from the saline and brackish marshes in the lower basin. The primary goal of this project is to establish a longdistance pipeline capability for conveying Mississippi River sediments for land building (marsh and ridge) to strategic areas of the central Barataria Basin. The secondary goal of this project is to restore marsh, the amount of which will be defined during the engineering and design process. The currently envisioned 12 to 20 mile pipeline route/corridor begins in the Myrtle Grove-Alliance area (Plaquemines Parish) and extend across Jefferson Parish to the west and northwest of Litt le Lake (in Lafourche Parish) and would be sufficient to support a 30 inch slurry pipeline. Phase I from the Mississippi River to the Bartaria Bay Waterway is currently under construction. Phase II would complete the pipline cooridor establish reuse strategies and infrastructure for future, larger-scale, systemic-benefit marsh and ridge restoration and creation projects in the central Barataria Basin portions of Plaquemines, Jefferson and Lafourche parishes. Funding for Phase I, approximately $66 million, include State of Louisiana CIAP funds, State of Louisiana Surplus Funds, and local CIAP funds ($1M each) from Plaquemines, Jefferson and Lafourche parishes. Phase II has not been funded. However, Jefferson Parish has compiled existing data into a conceptual design report and identified affected landowners to inform the permitting process. The Phase II project would utilize the same river sediment source as Phase I and initial research for the LDSP include an alternative analysis of alignments from the river to Lafourche parish; existing data and reports should will help to reduce the time needed to permit.	Lafourche Parish	$84,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Bayside Segmented Breakwaters at Grand Isle, LA	The purpose of this project is to reduce erosion on the bay side of Grand Isle, the only inhabited Barrier Island in Louisiana. Sixteen (16) 350-foot breakwaters (approximately 1.1 miles) are proposed for construction on the back-bay side of Grand Isle on state water bottoms . The sixteen (16) breakwaters are proposed between existing breakwaters to the east and west that were previously constructed. In 2014, nine (9) breakwaters were constructed to the immediate west of the proposed project with $3.3 million of Jefferson Parish's direct Coastal Impact Assistance (CIAP) allocation. In 1994, the U.S. Corps of Engineers constructed 13 breakwaters to the immediate west of the CIAP-funded breakwaters, and in 1995, the state funded construction of 8 breakwaters to the immediate east of the proposed project. Grand Isle beaches were heavily oiled with MC252 from the Deepwater Horizon oil spill over a period of several years, and this shoreline protection project would help mitigate those natural resource damages. The proposed project is designed, permitted, and shovel-ready, and the project's construction should be completed under NRDA's Early Restoration program, completing the protection of Grand isle from back-bay erosion. The proposed project will protect the bayside shoreline of Grand Isle; 304 acres of marsh, serving as habitat for migratory birds; the La. Dept. of Wildlife and Fisheries Research Laboratory and the Sea Grant Oyster Hatchery, the port of Grand Isle and the entire community of Grand Isle.	Jefferson Parish	$5,000,000
	Improving Gulf fisheries.	Improving fisheries by growing plankton. How to do that? Bringing up deep waters that are inherently rich in nutrients, which in turn will feed phytoplankton at the bottom of the food chain at the surface. Surface waters are low in dissolved silica (~1uM), having been used up by the phytoplankton, and then rises below the photic zone (>200uM). Phosphates are low (<0.1uM) in surface waters, and rise to ~1.5uM depending upon which body of water: Pacific, Atlantic, Gulf. This excludes phosphate run-off near coast. Nitrates are similarly low at the surface (<2uM), and rise to 15-20uM below the photic zone. The chemical equation for the ocean (phytoplankton mostly) is 106CO2 + 16HNO3 + H3PO4 + 122H2O + trace elements and vitamins --> C106-H263-O110-N16-P + 138O2 ("The Oceanic Phosphorus Cycle", by Adina Paytan, and Karen McLaughlin in 2007) Phosphate is rate limiting ingredient, then nitrogen. Dissolved silica doesn't show here but is quite important for siliceous diatoms If ocean water from let's say around 1-2km is pumped up, it would feed phytoplankton and thereby aid all fisheries (fish, and all plankton eaters, corrals, shellfish) I propose that oil rigs in abatement (after oil production, but before they are destroyed, work with Bureau of Safety and Environmental Enforcement), those in 1km or deeper water, be used. Power for the rig will come from Gulf currents (~30cm/s in top 300m) be used to power air compressors. High pressure hoses will be needed to pipe the compressed air down to 1-2km. Pressure needed is ~100atm/km and is quite reasonable. Put the equivalent of aquarium bubblers on the end of the air hose. Attached the air hose to one of the mooring lines for the oil rig. This will 1) aerate/oxygenate the anoxic deep water; 2) entrain deep water to the surface. Smaller bubbles entrain more water and oxygenate better. One side effect is the coldness from the deep water will lower humidity in the Gulf, which will lessen hurricane strength since they are powered by humidity (correlated to surface temperatures). A second side effect will be the increased dimethyl sulfide produced by more phytoplankton (upon their eventual death) which is a cloud condensation nuclei (CCN). There is a possibility of more cloud cover downwind from where the plankton growth will be. A third side effect will be absorption of CO2 into biomatter. There are other ways to bring the deep water to the surface, and using compressed air is the least expensive, upfront cost method until it is a proven method. There are other ways such as using a "siphon", with a tube going down 1km brought up into the top 300m. We allow the low-pressure wake of the tube from the Gulf current to siphon the waters up with no power needed to move the water. That tube will cost more upfront, however.		
	Buyout of Longliners' Use of the Gulf of Mexico During the Bluefin Tuna Spawning Season	I suggest that in distributing funds ($2.4 billion) received from the settlement of British Petroleum's Deepwater Horizon oil blowout, consideration be given to recovery of the marine organism whose population, while already dangerously close to extinction, was the most directly and severely affected by the disaster – the bluefin tuna. I believe the best way to do this is to close the entire Gulf of Mexico to commercial fishing for highly migratory species (HMS) during the period when adult western North Atlantic bluefin are using the area for spawning (late April through early June of each year) and to pay commercial vessels not to fish in the closed area each year for 10 years until a full recovery of the population to a healthy level can be demonstrated. The amount to be disbursed to each vessel with a demonstrated history of recent landings of HMS species during April through June at ports in the Gulf of Mexico (including Miami) could be based on average net revenue of the fleet during the closure period plus an annual inflation adjustment. The annual allocation of funds (following each year's closed season) could be made as a lump sum to the Blue Water Fishermen's Association, which represents all the involved fishing vessel operators. Violators could be sanctioned by suspension of their HMS permits for an appropriate period of time. North Atlantic bluefin tuna spawn only in the Mediterranean Sea and in the Gulf of Mexico. They are two separate and distinct populations. The South Atlantic bluefin tuna population was extirpated by commercial fishing in just 10 years (1960-1970) once its spawning area off Brazil was discovered. The western North Atlantic population spawns each May in the north central Gulf of Mexico. Many of ilts eggs and larvae would thus have been carried by the Loop Current directly into the Deepwater Horizon's plume of toxic petroleum and toxic dispersants where they would die. Because of overfishing on this the world's most valuable f ish, the western North Atlantic population - "our" bluefin tuna - has declined in abundance by about 98% since 1960 (for the details, see my website, www.BigMarineFish.com/bluefin.html). As a result, on May 24, 2010, the Center for Biological Diversity petitioned the U.S. federal government to "list" the North Atlantic bluefin as "threatened" or as "endangered" and to protect it under authority of the Endangered Species Act. If the adult bluefin can be protected where they are concentrated in a relatively small area for spawning, we should be able to reverse the recent succession of poor year class formation thus allowing the population to recover and providing much greater value in increased catch through time for both recreational and commercial fishing interests. The closure would also reduce mortality of severely depleted Atlantic blue marlin, white marlin, a variety of sea turtles and the great number of other non-targeted marine life which are caught and die particularly during this season on longlines set for the "money fish" (swordfish and yellowfin tuna). Accordingly, such a program should have the support of bluewater (HMS) commercial fishermen, commercial fisheries businesses, chefs, offshore sport fishermen, conservationists and the public. Economic benefits to both the commercial and sport fishing industries of increased survival of populations of not only bluefin tuna but also other premiere big game fish (e.g., blue marlin, swordfish, white marlin, sailfish, etc.) would be many times the annual cost to fund the proposed longliners' buyout.		$10,000,000
	Gulf Accesses-Land Formation	Are there to many gulf accesses or openings? Over many years accesses were made to the gulf that might slow down the land build up processes. Should several of these openings be closed off allowing sediment to be kept from being distributed into the Gulf! How was the land exteriors islands formed 50 or 100 years age? Did several openings exist? Also, are fresh water diversions operated properly? Are salinity levels monitored? The diversions should be opened and closed with spring flooding of the Mississippi River with fluctuation of flow rates. Creation of more recycled oyster shell reef will help trap sediment and create land with the ebb and flow of tides and fresh water diversions. Monitored salinity levels will keep existing oyster reef alive. In other words, the system must be closely balanced. Could portable bulkheads with tidal openings be build and encircled certain land areas, as sediment is trapped and land is build the bulkheads lifted and moved. Recyled oyster shells then could be placed close to shore up new land formation and prevent new land from eroding away again!		

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	"BP" The Blue Print for Restoring the Gulf's Fisheries	This program will allow Fishers and NMFS to test and address some of the possible management strategies that the fishing industry has recommended to Gulf of Mexico Fishery Management Council since the Oil Spill. It will contain the basic blue print of those recommendations. It will help to address the needs of the commercial reef fish fishermen in the Gulf of Mexico with their by catch of regulatory discards. This will benefit the fishery by having those fish available to the market place instead of being thrown back into the Gulf Waters.This provides benefit to the fisherman, the consumer of the resource, the coastal communities and the living marine resource. This program will allow the fisherman a way to participate at a cost that may not be available to them now.Plus it would help distribute the fishery resource among the coastal states and the profit from the product to the local community. This program will lease fish from Red Snapper and Grouper Allocation holders and make them available at a reduced price to those that presently have a commercial reef fish permit and do not presently hold adequate allocation to address their by catch. There will be the necessary safe guards build into the lease so that those purchasing the leased fish will have to fish them. The second phase will have a working group meet to discuss the success they have had with a fish tagging system and various ways to administer the program in a such a way that there may be additional benefits to such a program. Their are methods the states could use to administer the program so that there are no added cost for the states should such a program be done as management in the future. This second phase of the program will help to also address the needs of the charter for hire and special tournament needs for the private angler and the private angler that has not been able to fish due to close seasons and disasters. This program would be done through a fish tagging program and w ill require the fisherman, the states, the science center and NMFS coming on board. This would be done at a extra cost to the program for the second phase. This program would help to address the regulatory discards in the recreational community and will benefit the coastal communities through tourism. The charter for hire could use their fish tags when it was beneficial to their business and community and the Tournament caught fish will allow the private angler the opportunity to fish out of season when their season is closed, as well as the private angler that has not had the opportunity to fish during closed seasons and disasters. These programs will help the managers with the recommendation they make for management for the future. These programs will be protecting the fishery by reducing by catch while producing income and food for the Nation. This "Blue Print for Restoring the Gulf Fisheries brings Opportunities" that will be lost if not funded!		$8,000,000
	Chenier Ronquille Island Shoreline Protection & Sea Rise	We have designed and patented a system that will help control effects of sea rise. Our system will provide shoreline protection, will enhance building of habitat, and will assure land building. Designed to replace rock jetty, our new concept (Geo-TECH-Jetti) is installed above the water line, considering projected sea rise (as determined by official government determinations) Our Geo-TECH-Jetti units are filled with dredged material sourced from near the installation. Within a prepared area on top of the Geo-tech containers are Root-Zone Humus-filled, (RZHO), biodegradable containers. The RZHO-filled containers are planted with mature native marsh grasses and other select native plants. Our specialized method, proven in several previous deployments, ensures highly energetic and sustained plant growth, while providing shoreline force and sea-rise protection. Once set in place the Geo-TECH-Jetti units are stabilized with XX heavy duty PVC pipe, driven down 7 feet for firm hold, there are stainless steel rings on the bottom of units in three locations for PVC pass through. The PVC stabilization devices are designed so that they can be retrieved at a future time, when it may be determined that plant rooting and accretion has been achieved and our "hold" feature is no longer needed. Our proven methods allow for replacement of rock as stabilization means. Using our proven methods, we ensure rapid reestablishment of habitat. Shellfish, fin-fishes, invertebrates, and other vital coastal organisms are able to reestablish populations. Installing our Geo-TECH-Jetti units, we accomplish rapid rebuilding of the entire food-web, by providing the multiple benefits. (1) We provide protection from sea-rise. (2) We ensure rapid establishment of native plants along shorelines, making possible rapid habitat establishment. (3) Our methods assure accretion, as the long, well-set units of Geo-TECH-Jetti prevent erosion. (4) The Geo-TECH-Jetties also provide protection from surfa ce and sub-surface oil encroachment on shorelines and into adjacent marshes. (5) Shoreline areas of land, (marshes or barrier island shores), behind the rows of Geo-TECH-Jetti units are filled with dredged material has our process continues, the filled RZH and RZHO are applied to ensure fertility. The Geo-TECH-Jetti is set in place from barges. Our Geo-TECH-Jetti Placement System makes it possible for us to position units efficiently, one in front of the other, and over lapping with space between them allowing existing habitat to continue functions as installation is accomplished. If it is decided that marsh or shoreline is not to be filled in some areas where Geo-TECH-Jetties are being installed, our units are set next to each other and can be used to serve as solid shoreline protection without back-filling. Drawings can be provided.	Plaquemines	$7,822,392
	Process model for intertidal and salt marsh contaminant prediction	Background The introduction, deposition, and remobilization of contaminants in salt marshes are driven by hydrodynamics. There are multiple scales for these processes, which complicates attempts to elucidate the fundamental processes behind a given set of observations. There are at least three levels of interaction between chemical and physical mechanisms: (1) the intertidal marsh; (2) estuaries; and (3) basin-scale. The flow within a salt marsh is localized and occurs within both flats and channels with significant impacts from the canopy. This problem is not restricted to local circulation within bays, but can also reflect far-field processes because of the variability in the Loop Current, which can lead to the introduction of pollutants from the Caribbean Sea. The introduction of basin-scale contaminants is the subject of much interest of late because of potential for seepage from deep-water oil platforms. This recognition has been made available through web-based applications. In addition to the tidal and cold-front impacts on shoreline circulation and geochemistry, it is important to consider the infrequent occurrence of tropical cyclones, which cause greater changes over short times. The impacts of tropical cyclones are more erratic. Coastal bays and lakes contain storm layers that can remobilize soil-bound pollutants. Storms are a major factor in the long-term management of coastal features like barrier islands in the Gulf of Mexico, and these coastal features share common growth cycles that will impact future pollution studies. These storms are a major cause of exchange between the inner shelf and coastal wetlands, and their contribution to the movement of organic matter has been quantified. These physical processes are being documented and preliminary quantitative tools are being developed to represent the morphological changes. It is, however, necessary to relate these physical changes to the expected pollutant transport processes. Work has been com pleted on the interrelationship between the Mississippi River and marsh geochemistry. A similar approach should be integrated into a marine shoreline geochemical model. These physical and geochemical processes must be understood in terms of the long-term evolution of the Mississippi-Atchafalaya shoreline/marsh system if potential errors in coastal planning are to be avoided. Many pieces of the northern Gulf of Mexico ecological puzzle already exist. There are also multiple efforts underway to merge these into a comprehensive program. The recently formed Gulf of Mexico Research Initiative (GoMRI) is intended to be a research support mechanism for independent research at academic institutions. The overall development of a comprehensive approach to this problem has been described on the GoMRI web page using five themes: (1) Physical distribution, dispersion, and dilution of petroleum under the action of physical oceanographic processes, air-sea interactions, and tropical storms; (2) Chemical evolution and biological degradation…and subsequent interaction with coastal, and deep-water ecosystems; (3) Environmental effects…and the science of ecosystem recovery; (4) Technology developments…; and (5) Impact on public health. These themes are being pursued in a number of research projects. The fate of organic carbon in coastal wetlands is being investigated by Wang at LS. Ecosystem level effects of oil have been documented by ongoing studies on carbon dynamics and the impact of petroleum on the ecosystem. These investigator studies have been supplemented by large grants to consortia to develop more extensive research programs that fall into eight projects with underlying objectives as follows: (1) petroleum impacts and degradation in seawater and seafloor sediments; (2) oil distribution, impacts, and degradation on Louisiana shelf and wetlands; (3) integration of numerical models from plume to shelf scales; (4) experimental and model studies for oil degradation; (5) meas urement and modeling study of oil impacts, transport and deposition in Desoto Canyon; (6) small-scale physical, chemical, and biological degradation of oil; (7) oil behavior at DWH site; and (8) multiscale numerical model integration with observations and particle tracking, supported by experimentally determined mixing parameters. Objective It is not possible to study every possible interaction in an ecosystem as large as the wetlands of the northern Gulf of Mexico. Previous and ongoing work demonstrates the complexity of the marine and coastal environment. These studies tend to fall into different categories that are best described by physics and scale. The scale being predominantly studied depends to a large extent on the physics being considered. The physical processes in the GoM are mostly studied at space scales > 1 km. Studies of higher resolution problems tend to be isolated from basin scale studies. Gulf of Mexico Research Initiative (GoMRI) projects aim to address this issue, but the specific models used (i.e., Plume Model-ROMS-SUNTANS) may not be well suited for integration from the deep to intertidal ocean. The problem is not so much in the integration of the circulation models, but in the lack of an environmental model to make use of the hydrodynamics. The part of this puzzle that is missing is a numerical model that integrates the small-scale chemical/biological processes with the larger scale hydrodynamic processes represented in typical coastal modeling approaches, like those proposed in projects (1) and (8). The key to this integration is the use of ecological or water-quality models. This work would adapt such a model to the coastal wetlands ecosystem in order to span the time and space scales that govern the long-term response of this environment to short-term events like storms and oil spills. Characterization of flow patterns within estuaries is mostly a function of understanding the relationship between meteorological, oceanographic, biolog ical, and geological phenomena.	St. Bernard	$350,000

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	Erosion Prevention, Marsh Creation and Land-Building	Shoreline and Marsh erosion prevention and land building, with new designed geotextile containment units (GEO-TECH- Jetti), with planted native plants and grass in RZHO. GEO-TECH Units are spiked with XX Heavy Duty PVC Pipe for stabilization. This is help Shoreline Erosion Control, Stabilization, Accretion, and Habitat Assurance and "coast building." This new concept will co-inside with the two other projects submitted. Confirmation #'s WPXWHOC2 and 2KE7KQ8Q Would like to summit Power Point Presentation, please send email address.	Terrebonne,Plaquemines,St Bernard,Harrison,Jackson,Mobile,Escambia	
	Ecosystem Based Restoration Project Management and Decision Support System	As multiple restoration projects are implemented in the northern Gulf of Mexico, there is a need to understand and quantify impacts on the ecosystem. Furthermore, there is risk that interactions across projects may have "unintended consequences". For example, changes in water quality such as salinity and sediment load may adversely impact desired habitat conditions (e.g., oyster reefs and marsh restoration. This could result from freshwater diversions and changes in circulation with barrier island construction. Consequently, a method that informs ecosystem based management is needed. This proposal is to develop and deploy a placed-based decision support system (DSS) for scientific assessments of synergistic interactions of multiple restoration projects. The DSS will be built using existing technologies and data for conducting scenario analyses and simulations. Existing models and ongoing ecosystem assessments will used to develop a place-based DSS. Projects and their alternative will be assessed using Multi-Criteria Decision Analysis (MCDA). MCDA provides a systematic tool for identifying a preferred course of action when considering multiple forms of dissimilar information and differing value judgments among stakeholders. The DSS will allow managers to evaluate impacts of multiple projects on the overall quality of the ecosystem in the northern Gulf of Mexico and provide science based assessments for adaptive management as restoration projects develop over time. Enhanced assessment techniques will be used to evaluate the stability and sustainability of projects during construction and post construction. The project will be a collaborative effort with engineers and scientists from Mississippi State University (MSU) and the University of Southern Mississippi (USM) and will be coordinated with state and Federal agencies conducting restoration in the northern Gulf of Mexico. Emphasis will be placed on projects in the Mississippi Sound and Lower Mississippi River. More detailed proposal is available upon request.		
	Breakwater Park West End	The proposed Breakwater Park at the historic West End of New Orleans will consist of large greenspaces on the shores of Lake Pontchartrain. The park has undergone the planning process through the Louisiana Regional Planning Commission. Funding needs consist of fill, vegetation, shoreline stabilization, bikeways, beach fill, parking, restrooms, small outdoor pavillion, boardwalk, electrical & plumbing, lighting, sidewalks, parasailing launch area, catamaran launch area, etc. Located in the largest population center directly affected by the oil spill, this project seeks to return the public to the shores of Lake Pontchartrain as well as improve the health of the entire Lake Pontchartrain Basin ecosystem via shoreline breeding habitats and marine bird habitats.	Orleans	$50,000,000
	West End Park Lagoon Habitat	Located in historic West End Park in New Orleans, the East Lagoon is in need of shoreline stabilization, stocking and culvert repair to re-establish water transit between itself and Lake Pontchartrain.	Orleans	$200,000
	Linear Wetlands Park	Located along Breakwater Drive on the south shore of Lake Pontchartrain in the historic maritime district of West End in New Orleans, the non-profit organization - The Friends of West End - seeks to construct a linear wetlands park in conjunction with the Municipal Yacht Harbor Management Corporation and the Lake Pontchartrain Basin Foundation. Consisting of dredge and spoil material used to construct a marsh ecosystem that would benefit the health of Lake Pontchartrain and downstream waterways by creating a new shoreline breeding habitat. Further, the project would include a boardwalk and educational kiosks seeking to educate the New Orleans public on the need for a healthy Lake Pontchartrain. This project has been approved via a master planning process coordinated by the Regional Planning Commission.	Orleans	$15,000,000
	A comprehensive examination of bottlenose dolphin (Tursiops truncatus) stock structure and habitat characteristics in the north central Gulf of Mexico	The Mississippi Sound supports one of the largest estuarine bottlenose dolphin populations in the world; however, the lack of a current stock assessment and subsequent poorly understood stock structure and habitat use within the region make this area ripe for study. Furthermore, the longest running unusual mortality event (UME) in the history of the northern Gulf of Mexico has resulted in more than 750 bottlenose dolphin strandings with over 250 occurring along the Mississippi coast. Gauging the effects of the UME and potential causative factors associated with unprecedented mortality requires an accurate understanding of stock structure and environmental factors controlling movement within the region. This purpose of this project is to conduct long-term, comprehensive monitoring of population dynamics and habitat characteristics of bottlenose dolphins in the north central Gulf of Mexico. Transects spanning the entire Mississippi Sound will be surveyed multiple times each season to generate population estimates based on distance sampling theory. Additionally, photo identification survey routes will be traveled within the study area several times each season to make population estimates using mark-recapture statistics. Photo identification data will also provide critical insight into stock structure within the region as it will elucidate home ranges, site fidelity, and seasonal movement patterns of individual dolphins. Intensive water quality sampling at regular intervals at established locations throughout the Mississippi Sound will accompany line transect and photo identification studies to gauge the effects of environmental factors (e.g., temperature, salinity, dissolved oxygen, etc.) on the species. Additionally, potential prey items will be sampled in selected areas within the region to better understand feeding ecology of bottlenose dolphin stocks. Bottlenose dolphins are apex predators that can reliably indicate overall ecosystem health. Thus, monito ring bottlenose dolphin habitat use in response to environmental variation is crucial for understanding the health of the Mississippi Sound and the larger north-central Gulf of Mexico. This work will be augmented with population dynamics and environmental data collected by IMMS over the last ten years, and will be critical for understanding the effects of recent disturbances and promoting recovery and enhanced management of this sentinel species.		$10,000,000
	Bayou Sale Shoreline Protection (TV-20)	This project is listed under the CWPPRA program as project number TV-20, http://lacoast.gov/reports/managers.asp?projectNumber=TV-20 Eroding shoreline at an estimated rate of 13.5 ft/year has been caused by the open water fetch and resulting wave energy from East Cote Blanche Bay. The resulting shoreline has resulted in a substantial loss of live oak forest, emergent wetlands and critical habitat used by a multitude of fish and wildlife species including the endangered black bear. The goal of this project is to reduce and/or reverse shoreline erosion and create marsh between the breakwater and existing shoreline. The project was originally envisioned as a rubble mound dike, up to seven miles in total length. However, the presence of known oil and gas infrastructure and a large number of magnetic anomalies makes rock construction unfeasible. The team has identified a possible solution, using a product such as the OysterBreak (http://www.wayfarertech.com/oysterbreak/oyster-reef-building). Such a structure could be constructed with shallow draft equipment such as conventional barges or specialty vessels available in the area, thereby eliminating the need to dredge access channels. This option would allow the floating construction equipment to safely pass over known pipelines and unidentified magnetic anomalies. It is understood that no oysters would grow on the structure; the OysterBreak would function as a concrete armor unit breakwater. In summary, this proposal consists of up to approximately seven miles of the OysterBreak Shoreline Protection System, with gaps as appropriate to allow fisheries access, and to avoid known pipelines and unidentified magnetic anomalies.	St. Mary	$18,000,000

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	Rabbit Island restoration	The purpose of the Rabbit Island West Cove Calcasieu Lake Beneficial Use Restoration Project is to provide improved habitat for nesting birds in the West Cove of Calcasieu Lake in Calcasieu Parish, Louisiana through the beneficial use of dredged material. Rabbit Island has historically been a rookery for a large number of pelicans and colonial birds and serves as the westernmost rookery in the state of Louisiana. This restoration will ensure Rabbit Islands remains a viable rookery for the brown pelican as well as other nesting birds. It has been observed that nests on Rabbit Island frequently fail from flooding by tides and waves. Higher tidal amplitudes from larger volumes of water coming up the Calcasieu Ship Channel are a primary cause for the more frequent flooding on Rabbit Island. Part of the flooding is also due to larger wind-generated waves caused by increased fetch as more marsh is lost along the fringe of West Cove. The low elevation and lack of shrubbery on the island causes pelicans to nest on the ground and periodic high water drowns the nests, resulting in failed breeding attempts. The amplified tides are the primary cause for the more frequent flooding on Rabbit Island. The erosion has also been expedited by previous hurricane storm surges, subsidence, sea-level rise, wave processes, and low topography at or below sea level. These impacts have diminished the Island's historic topographic elevation and shoreline characteristics to the point that the Island's ability to function as a viable rookery is in jeopardy. Features of the Rabbit Island Restoration project for the Brown Pelican will include: nearness to open water; separation from the mainland; approximately 20% of nesting areas with dune/shrub habitat; and approximately 2500 feet of shoreline protection. The topography of the island will be elevated and contoured to include those features critical to successful nesting of pelican and colonial birds. This habitat will add an important dimens ion to the resources of the lake, and will help to broaden the range of nesting areas for the brown pelican. When the restoration is complete, Rabbit Island will be not only the western-most rookery but also the premier rookery for the brown pelican in the state of Louisiana, adding significant habitat for the pelican and other colonial birds and helping to preserve these valuable resources. By using dredged spoil from the Calcasieu Ship Channel, elevations on the Island will be raised and the topography sculpted to enhance the nesting areas and build a world class rookery for colonial birds and the brown pelican. In 2003 it was observed that there were 8 nests of pelicans on Rabbit Island that resulted in 5 young birds. In 2010, 500 nests produced over 1,000 young. Over 100 rehabilitated pelicans impacted by the Deepwater Horizon Incident have been relocated to Rabbit Island. Daily morning monitoring of the status of these rehabilitated birds indicate that 1,000 to 3,000 pelicans are using the island for refuge. Thousands of shoreline and colonial birds also benefit from the refuge and habitat provided by Rabbit Island. Implications The use of dredged spoil from the Calcasieu Ship Channel, elevations on the island can be raised and the topography can be sculpted to enhance the nesting areas and build a world class rookery for colonial birds and the brown pelican. Restoration of the island adds an important dimension to the resources of the Calcasieu Lake, helps broaden the range of nesting areas for the brown pelican, and is an excellent example of the beneficial use of dredged material. With many barrier island nesting grounds under attack due to coastal erosion and environmental impacts, the Rabbit Island rookery will be even more important in demonstrating the value of beneficial use of dredge material.	Cameron	$7,000,000
	the Marinovich Proposal	WHY Pertaining to the adult shrimp coming out of the gulf. Protect the adult shrimp coming out of gulf to spawn so they will be will able to reproduce without be caught up by trawl. change (tweak) the shrimp laws close the season from last week in march do not open until last week in June Re-closed in August not reopened end of three week into September. This may fix a FAILING INDUSTRY and bring back multitudes of jobs (INCREASE shrimp population CUT DOWN ON DRAG TIME for fisherman which will make trip shorter and less fuel.. (More shrimp for fish to eat for red snapper ,speckled trout)		
	Coastal Ecosystem health: American Oystercatcher as an indicator of exposure and effects of pollutants on breeding birds on the Gulf Coast	The Gulf Coast of Mexico is one of the most important regions in North America for bird-watching and outdoor activities. Bird conservation along the Gulf Coast is of primary importance because it contributes to the conservation of natural resources but also because it provides economic incentives to the coastal communities by increasing tourism, including bird-watchers and nature lovers to the region. Thus, maintaining healthy bird populations along the coast is important from an economic and ecological standpoint. Fish-eating birds are at the top of the food chain and often accumulate more contaminants than other species at lower trophic levels. American oystercatchers feed on bivalves which are also consumed by humans. This study could be used to assess general ecosystem health and potential impacts of contaminants in bivalves on human health. This research project will address the impacts of environmental contaminants on aquatic birds breeding along the Gulf Coast, using the American Oystercatcher (Haematopus palliatus palliatus) as an indicator species. Coastal wetland areas, estuaries, and islands along the Gulf of Mexico coast constitute a primary nesting and feeding ground for many North American birds. Most of the species nesting on these areas are waterbirds which nest in colonies and feed on aquatic vegetation, invertebrate organisms, and fish. Exposure to environmental contaminants in these species can occur through the diet, but also directly through dermal absorption, preening, and inhalation. To our knowledge, up until now, there has not been a complete assessment of the potential impacts that environmental contaminants in the Gulf of Mexico could have on many aquatic birds, including species of special concern and in need of protection. The results of this research can also be used to determine the health of coastal areas and their potential associated impacts on other species of concern, i.e. fish, shellfish, and humans.		$4,800,000
	Conservation and evaluation of limiting factors for American Oystercatchers along the Gulf Coast	The American Oystercatcher (Haematopus palliatus) is the most widely distributed of the four oystercatcher species found in the Western Hemisphere with a range stretching from the northern U.S. Atlantic Coast to the tip of South America. The total population is estimated to be 43,000 with the subspecies found in the U.S. (H.p. palliatus) making up 20,000 of that total. The U.S. population is estimated to be 11,000. American Oystercatchers are restricted to the narrow band of the coastal zone throughout their range where they feed mainly on oysters and other bivalves. The threats to their survival are many and include a low overall population size, low reproductive success, and delayed breeding (3+ years of age). Productivity rates from the Atlantic Coast range from .30 to .50. Nests are subject to a whole host of mammalian, avian, and even reptilian egg and chick predators and are also subject to overwash from high tides and tropical storm events. Chicks can starve to death during high tide events when the adults are unable to find enough food. Because oystercatchers nest in the coastal zone, disturbance from human recreation is common and exacerbates other natural threats. Sea level rise is major threat to oystercatcher survival. The U.S. Shorebird Conservation Plan lists the American Oystercatcher as a species of high concern, it is a National Fish and Wildlife Foundation (NFWF) priority species, and it is included on the list of Texas Parks and Wildlife Department's priority species. The majority of projects associated with the American Oystercatcher have been along the Atlantic seaboard with limited focus on Gulf Coast populations. In 2011, the Gulf Coast Bird Observatory embarked on a multi-year study to fill information gaps on Gulf Coast oystercatchers. We have learned much from our work so far but there are still many unknowns. We have only begun to scratch the surface of understanding of oystercatcher conservation however as there remain many unanswered qu estions. Our primary focus would be to determine how and why eggs go missing from nests and how vegetation aids in chick survival. It appears the vegetation provides chicks with critical refugia from predation but we do not have a complete picture of what type of vegetation works best. We propose to expand oystercatcher nest monitoring throughout the Gulf to determine if other Gulf oystercatchers have similar productivity and threats as Texas oystercatchers. We propose to deploy motion activated video cameras to capture egg predation events and determine without question what is causing them so that we can counteract this with appropriate conservation measures. Thirdly, we propose to conduct a detailed vegetative analysis of oystercatcher nesting islands to determine which type of vegetation provides the best chick refugia. Without this information we cannot successfully create more oystercatcher nesting habitat.		$5,800,000
	Chef Menteur to Rigolets Restoration & Protection	The Conservation Fund (TCF), and its project partner Ecosystem Investment Partners, are pursuing funding to complete the full restoration of this 16,500 +/- acres of coastal marsh intermixed with marine/ estuarine habitats. Upon restoration, TCF expects the tract could be donated to a State, or Federal agency, or another non-profit, for public use and long-term stewardship. This tract represents approximately half of the land bridge area which is the interface between the marine environment within the Lake Borgne/ Gulf of Mexico, and the estuarine system within Lake Pontchartrain. This coastal wetland complex supports a significant local fishing industry, as well as hunting and other recreation based tourism. With significant frontage (approximately 14 miles) along Lake Borgne/ Gulf of Mexico, this tract provides important aquatic habitat, as well as critical migratory bird habitat on the front line of the Gulf of Mexico. Louisiana's 2012 Comprehensive Master Plan for a Sustainable Coast calls for 8,510 acres of marsh creation to occur on this site. This complex contains a variety of coastal wetland components, including salt and brackish marshes, lagoons, canals, cheniers (former beach fronts) and natural bayous. The marshes along Lakes Pontchartrain and Borgne serve as estuarine nurseries for various fish species, crabs and shrimp. These diverse habitats meet the needs of up to 340 bird species during various seasons of the year. Peak waterfowl populations of up to 25,000 use these wetland areas during the fall, winter, and early spring months. In addition, wading birds, shorebirds, brown & white pelicans, raptors, a variety of mammals, along with numerous reptiles and amphibians are found within the habitats provided.	Orleans	$100,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Stabilized Soil Shorelines along Barrier Islands	Barrier Islands are an important feature necessary to protect the coastline from further erosion. It is a great idea to reconstruct these barrier islands using native materials, but if the material doesn't stay in-place after a hurricane storm surge passes it has served no purpose except to delay coastal erosion. However, if native materials were stabilized with reagents along the perimeter edges of the restored barrier islands, the barrier islands stand a much better chance to not erode away. Stabilized edges along the perimeter of restored barrier islands will be strong enough to withstand storm surges and keep the native non-stabilized material in-tact. The stabilized perimeter can also serve as access to remove any oil or tar balls that resurface from the spill. Stabilized soil or spoils have a much lower unit weight than regular clay, and will not soften even in immersed conditions. Let's protect our work with stabilized shorelines to avoid expensive rework that will occur after the storm.	Plaquemines	$15,000,000
	BP Deepwater Horizon Oil Spill Restoration Evaluation and Monitoring Program	The Natural Resource Damage Assessment regulations make clear that final Restoration Plans should include a monitoring component so that the effectiveness of restoration measures can be evaluated. Given that BP is providing $1 billion for early restoration projects before completion of a Deepwater Horizon Restoration Plan, some of these funds should be used to establish a restoration evaluation and monitoring program. There is precedent for funding monitoring activities before an oil spill restoration plan is final. Before a restoration plan was complete, the Exxon Valdez Oil Spill Trustee Council invested funds in tracking injury and recovery at the species level, as well as research and monitoring at the ecosystem scale, to identify restoration opportunities, understand factors limiting recovery, and evaluate the effectiveness of restoration measures. An early and steady flow of information on the recovery status of specific natural resources and ecosystem services generated through this program would help managers make responsive management decisions. Without this information, less effective restoration may result, potentially requiring managers to restrict human uses of these resources. Specifically, a restoration evaluation and monitoring program is needed to: 1) evaluate the effectiveness of early restoration projects; 2) track the recovery of specific injured natural resources or lost or reduced services; and 3) report to the public on the status of injured resources, lost services, and progress toward restoration. Establishing a restoration evaluation and monitoring program for early restoration can be adapted as restoration needs change and transition into a longer-term program. On behalf of the Deepwater Horizon Oil Spill Trustee Council, NOAA, in cooperation with the Department of Interior (USFWS), is in the best position to establish and administer a Deepwater Horizon Oil Spill restoration evaluation and monitoring program. Together, NOAA and USFWS hav e the experience and existing infrastructure to coordinate monitoring across state-federal boundaries. Both agencies would serve as joint custodians of this program. This structure will facilitate the efficient gathering of data that will allow comprehensive monitoring of the full range of restoration activities. Regardless of the entity implementing monitoring, this program will require coordination among trustee agencies and possibly some new data gathering. Each year NOAA and USFWS would produce a report on the results of restoration measures, recovery of injured species, and newly discovered injuries.		
	WorldWide Consortium For Any DANGEROUS MANUFACTURING PROCESSES	1% FROM EACH COMPANY TO FUND RESEARCH AND TO BE ABLE TO STOP CONTAIN OR DIFFUSE DANGEROUS SITUATIONS THAT CAN BECOME HARMFUL TO THE PLANET AND ITS BEINGS ie. Valdez Oil Spill, Fukashima, BP, Chernoble, 3 mile island............... For the future of this planets sake.		
	Increase amount of assessments for potentially impacted finfish species	Proposed Restoration Project: Conduct more frequent stock assessment updates for overfished or near overfished Gulf finfish species and first-time stock assessments for lesser known, unassessed finfish species that were potentially impacted by the Deepwater Horizon (DWH) oil disaster. The information will be used to inform adaptive management of fisheries and promote recovery of populations impacted by DWH. Link to Injury: Many commercially and recreationally fished species in the Gulf of Mexico were exposed to oil or dispersants during the DWH disaster. As a result, potentially injured reef fishes, highly migratory pelagics, and sharks require closer monitoring for the next several years in order to help managers better track population status and trends and set catch quotas consistent with recovery from the DWH disaster. Benefit and Rationale: Finfish contribute to regional seafood sales totaling $17 billion and support a thriving recreational fishing industry, which generates nearly $10 billion in economic activity and supports 92,000 jobs in the Gulf of Mexico. Therefore, knowing the status of finfish populations through assessments is critical for effective management of fisheries and maintaining the health of the ecosystem and the fishing-related industries that depend on it. The 2010 DWH disaster may have affected the year-class strength of exposed Gulf fish species by reducing survival of eggs and larvae, or it could have reduced the spawning population itself through lethal or sublethal impacts. Sublethal exposure to oil and dispersants could, for instance, compromise the immune system of affected fish, and signs of compromised immunity in the form of external lesions and abnormal markings on fish (e.g., red snapper) have been documented by researchers at LSU and USF. The population status of Gulf species is assessed through the Southeast Data, Assessment and Review (SEDAR) process, which is the stock assessment process established by the South Atla ntic, Gulf of Mexico, and Caribbean Fishery Management Councils. These three Councils are all served by the Southeast Fisheries Science Center within NOAA Fisheries. All three Councils rely heavily on SEDAR assessments for generating science-based management advice for NOAA Fisheries. However, due to the large volume of managed species in the Southeastern U.S., only a small fraction of managed species are assessed in any given year, and many have never been assessed. Assessed species are managed through multi-year population projections in years between assessments, but episodic events such as hurricanes, red tides, or oil spills can affect the population in ways that can reduce the usefulness of the population size projections, potentially leading to inappropriate management decisions. For species that are nearing an overfished condition or are overfished, the DWH disaster may have further negatively affected population health. More frequent status updates are needed to ensure that these species do not become overfished or if a species is already overfished that rebuilding is on track. There are currently four species in the Gulf that are in rebuilding plans: red snapper, gag grouper, greater amberjack, and gray triggerfish. More frequent assessment updates for gag grouper may have been able to prevent the population from deteriorating from a near overfished condition in 2005 to severely overfished in 2009 (due to a 2006 episodic mortality event that reduced the spawning stock biomass by 18 percent). More frequent status updates may have also been able to detect the lack of progress in greater amberjack rebuilding and prevent missing the rebuilding deadline. Species impacted by DWH that have not been assessed present a unique challenge to fishery managers because less is known about their population status and how DWH might have affected populations. Managers need accurate population size estimates to detect changes in abundance that might be influenced by sub- lethal effects resulting from DWH. This information will facilitate adaptive management and recovery and help managers prevent overfishing while achieving optimum yield. Specifically, an evaluation of available data-poor assessment methods and application of the most suitable ones to unassessed, undermanaged Gulf species is needed. An additional need is a method for annually setting catch limits for these species that is based on feedback control to adjust for errors in our perception of population status and changes in abundance trends. Alternative catch setting methods, based either on results from simple assessment methods or empirical data, can be tested using simulations through the management procedure approach. Employing this approach would enable managers to choose the method that is expected to best meet management goals and to respond appropriately to any changes in population trends that may arise from DWH impacts. Description: Annual or biennial update assessments would be performed for previously assessed, managed Gulf species that have been determined to be overfished or are nearing an overfished condition. These updates would be done in house by the Southeast Fisheries Science Center or responsible state management agency without the physical, public workshop required by the more involved "standard" or "benchmark" assessment. Doing more frequent update assessments will require additional stock assessment expertise as well as additional data processors and analysts. For species requiring more frequent assessments, updating the data time series that go into the model would become a routine annual process that is performed by the responsible data curators. For minor, unassessed species, a series of workshops modeled after the SEDAR process would be held to evaluate current assessment methods for data-limited fisheries and apply the appropriate one(s) to Gulf fish species with unknown status. This project would consist of a workshop for assembling avai lable data, a series of webinars for applying and evaluating alternative assessment methods, a series of webinars for constructing and testing alternate management procedures (empirical and model-based), and another workshop for review of the process. To produce the best results, these workshops would incorporate many of SEDAR's characteristics such as transparency, openness to public participation and independent review and would involve the Center for Independent Experts (CIE). A university with relevant expertise and capacity would lead this project, with the involvement of federal, state, university, and NGO scientists, fishery managers and local fishery representatives. Every five years over a 10-year period, webinars and a workshop will be held to review and, if necessary, adjust management procedures.		$150,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Gulf of Mexico Fishery Management Restoration Priorities	At the October 29 - November 1, 2012 Gulf Council Meeting in Gulfport Mississippi, the Gulf of Mexico Fishery Management Council (hereafter: Council) discussed data needs to priorities for restoration activities in response to the Deepwater Horizon oil spill. The Council discussed potential impacts to important stocks, critical habitat, and humans due to lost fishing opportunities etc. The Council requests that upon settlement or through early restoration the following activities are given the highest priority: • Increase and fund frequency and number of stock assessments. • Enhance and fund fishery independent surveys, both federal and state. • Work with MRIP to decrease the frequency to two week waves for high profile species. • Develop and fund a more robust observer program. • Enhance/create and fund oyster restoration projects and coastal reef fish habitat. • Development of and funding for data collections programs for the headboat and for-hire sector and a charterboat electronic data collection system. • Research and fund projects on barotrauma tools for reductions in bycatch mortality. Each of these activities are critical to improving conservation and management efforts of federally managed fish species and associated habitat necessary to provide maximum benefit to the nation as required by the Magnuson-Stevens Fishery Conservation and Management Act.		
	GSMFC Cooperative Regional Monitoring Project	When the BP drilling rig Deepwater Horizon exploded approximately 50 miles southeast of the mouth of the Mississippi River on April 20, 2010, it caused significant damage to the waters of the Gulf of Mexico. In order to effectively assess the long-term effects of this event, there needs to be a coordinated regional approach in monitoring the status and health of the marine resources in the Gulf of Mexico. The Gulf States Marine Fisheries Commission (GSMFC) is uniquely poised to provide such an approach. Established by both state and federal statutes in July 1949, the GSMFC is an organization of the five states (Texas, Louisiana, Mississippi, Alabama, and Florida) whose coastal waters are the Gulf of Mexico. It has as its principal objective the conservation, development, and full utilization of the fishery resources of the Gulf of Mexico to provide food, employment, income, and recreation to the people of the United States. One of the most important functions of the GSMFC is to serve as a forum for the discussion of various challenges and programs of marine resources management, industry, research, etc. and to develop a coordinated approach among state and federal partners to address those issues for the betterment of the resource for all who are concerned. The GSMFC has a long history of successfully coordinating and administering cooperative, regional programs such as the Southeast Area Monitoring and Assessment Program (SEAMAP), Interjurisdictional Fisheries Program (IJF), Sportfish Restoration Program (SFRP), Fisheries Information Network (FIN), Economics Program (EP) and the Marketing, Traceability and Sustainability components of the Oil Disaster Recovery Program (ODRP). One of the reasons the GSMFC has been so successful is that it is a vertically-integrated organization that provides products and services that satisfy a common need to both its state and federal partners throughout the Gulf of Mexico. In addition, the GSMFC has sole-source authority, under the Magnuson Fishery Conservation and Management Act, Title IV, Sec 402(d), which will expedite the distribution of funds and quickly allow these important activities to commence. Outlined below are the various activities, by GSMFC program, that can be accomplished if the requested funding is provided. It is important to note that these activities will augment the existing long-term work (totaling $5,530,000) already being conducted and funded through the GSMFC. The total annual cost for all of the proposed GSMFC activities is $2,418,000. The duration of this proposed project is 10 years. With inflationary increases over a ten-year time period, the total cost of this project is $27,578,000. EXISTING & PROPOSED ANNUAL FUNDING REQUEST, BY PROGRAM EXISTING PROPOSED INTERJURISDICTIONAL FISHERIES PROGRAM $230,000 $434,000 SPORTFISH RESTORATION PROGRAM $200,000 $834,000 FISHERIES INFORMATION NETWORK $5,100,000 $1,150,000 GRAND ANNUAL TOTAL $5,530,000 $2,418,000 INTERJURISDICTIONAL FISHERIES PROGRAM (IJF) Introduction: The Interjurisdictional Fisheries Act (IFA) of 1986, as amended (Title III, P.L. 99-659), was established by Congress to: (1) promote and encourage state activities in support of the management of interjurisdictional fishery resources; and (2) promote and encourage management of interjurisdictional fishery resources throughout their range. Overview of Current Interjurisdictional Fisheries Activities: The IJF Program is the cornerstone of the fishery management programs for the states and has provided the support for long-term databases for shrimp and juvenile finfish in the Gulf of Mexico, which would otherwise not be available. In recent years, it has provided for regional planning efforts, by states, to manage nearshore resources similar to the Magnuson Fishery Conse rvation and Management Act of 1976. In essence, the IFA is to the states what the Magnuson Act is to the nation and the benefits of sound management under these acts do not accrue separately. The IFA is probably the single most important Congressional act to professionalize the states' scientific staff within the marine resource agencies. Proposed Activities: Activity 1. Expand Existing Management Plan Development: Task 1 - Creation of Management Plan Specialist Position. The GSMFC's IJF program must hold technical task force meetings to complete its current FMP workload in a timely fashion. At any point in time, the IJF staff is either developing or revising three or four FMPs simultaneously. FMPs initiated in a given year are carried over and completed in subsequent years; thus more than one management planning effort is ongoing in each year of the program. There currently is not adequate staff to maintain all the FMPs that are out-of-date and begin development for those species identified by the states not yet under regional management. A Management Plan Specialist position is needed to assist in the development of additional FMPs, profiles and revisions. Task 2 - Support Task Forces and Subcommittees. Following completion of the FMPs, task forces and subcommittees need to be maintained and kept active to ensure new and relevant issues in each IJF fishery are identified, review the status of the fisheries on a regular basis as required in the FMP process, and to coordinate regional management strategies that match the dynamics of these fisheries. Task 3 - Coordination of Fish "Age-And-Growth" Activities. The GSMFC continues the coordination of fish "age-and-growth" activities in the region through the Otolith Workgroup, in support of the Fisheries Information Network (FIN). The biological sampling activities under FIN are in direct support of both state and federal stock assessments which are in the FMP development process. There is a need to de velop additional methodologies and standardized techniques for species common to the five Gulf States. Task 4 - Support of Law Enforcement Committee. The GSMFC's IJF program has always supported its Law Enforcement Committee as funds have permitted. These activities continue with only administrative support and include participation with the Gulf of Mexico Fishery Management Council. The ability to provide financial support for GSMFC enforcement-related activities is severely limited. Task 5 - Support of Habitat Activities. The Habitat Program, which directly contributes to the development of FMPs under IJF, links the states' habitat components with fishing activities. The Habitat Program also coordinates and provides input to local and regional development activities that have an impact on important fisheries habitats. With additional funding, this program would provide distinct habitat descriptions and GIS output on the distribution of life history stages associated with specific life history requirements and habitat components of fisheries under current and future IJF management. Activity 2. Creation of a Stock Assessment Program (GDAR): Task 1 – Implementation of the GDAR Program. The Gulf Data, Assessment, and Review (GDAR) is intended to support the development of inshore, regional assessments required in the Commission's fishery management plans (FMPs). The GDAR is designed to mirror the federal assessment process (SEDAR - SouthEast Data, Assessment, and Review) to develop reliable fishery stock assessments for the Gulf of Mexico not evaluated through the federal SEDAR program. GDAR relies on the expertise available in the state marine agencies to develop an assessment through a transparent, open process. The completed stock assessments undergo a rigorous and independent scientific review to ensure consistent and appropriate use of all the available data pertinent to a specific fishery and establish population targets and thresholds for regiona l management. Upon completion of each assessment, the results will be incorporated into the FMP for use in future management by the five Gulf States' marine agencies based upon the goals determined and recommended by the TTFs and various species subcommittees in the FMP. Each assessment requires three meeting components which include the associated TTF and state marine agency analysts. Assessments are completed using three workshops; 1) the Data Workshop (DW) where datasets are documented, analyzed, and reviewed and the data required for conducting assessment analyses are compiled and standardized. 2) The Assessment Workshop (AW) where quantitative population analyses are developed and refined and population parameters are estimated. 3) The Review Workshop (RW) where a panel of independent experts reviews the data and final assessment model and recommends the most appropriate values of critical population measures. Task 2 - Support for GDAR/Creation of Stock Assessment Scientist Position. The GSMFC has created a program through IJF that mirrors the federal SEDAR (Southeast Data Assessment and Review) program in an effort to complete regional assessments of state managed species. The IJF Program is presently combining the GDAR (Gulf Data, Assessment, and Review) with the TTF meetings, but as more assessments are needed, the ability to continue funding GDAR is questionable. To assist with assessments and the GDAR Program, the GSMFC needs to create a Stock Assessment Scientist position to develop the regional stock assessments and assist the states with their analytical activities. This individual would coordinate and process the states' fishery data and work with the Stock Assessment Team to develop and integrate new models for stock assessment in the Gulf. Task 3 - Support of Stock Assessment Team. The GSMFC's Stock Assessment Team currently has no funding for regional stock assessments in support of FMP development. In addition, there is not a way to pro		$27,578,000
	marine sea oil spill cleanup	through cleanup marine oil spills,like the one in nigeria niger delta bonga oil spills,chevron nigeria oil spills, niger delta nigeria oil spills,using modern technology,if giving me the opportunity,i will done the beat of it.	U S A	$800,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Upgrades to the Electronic Logbook Program for the Offshore and Inshore Commercial Shrimp Fishery for a 5-Year Period	Project: Upgrade the Gulf of Mexico shrimp fishery electronic logbook (ELB) program in order to improve the precision of shrimp fishing temporal-spatial effort and estimation of red snapper and sea turtle bycatch in the shrimp fishery. Specifically, this project will purchase new ELB units and make program enhancements necessary to expand ELB coverage up to 100 percent of the offshore shrimp fleet and a higher percentage of the inshore shrimp fleets for a period of 5 years. Link to Deepwater Horizon Oil Spill Injury: In 2010, the estuarine and offshore waters upon which shrimp species depend were oiled, offshore and nearshore shrimp fisheries were closed and visibly oiled sea turtles were collected alive and dead from northern Gulf. Sharp declines in shrimp catch in SE Louisiana in 2011 may be related to habitat damage or adult or post-larval mortality caused by exposure to Deepwater Horizon oil or chemical dispersants used to break up oil. In addition, red snapper with lesions and other signs of a compromised immune system have been documented in the oil spill impact area, though cause and effect are not yet established. Benefit and Rationale: Inshore and offshore shrimp fisheries in the Gulf of Mexico are known to interact with sea turtles and juvenile red snapper. These two species' populations may have been detrimentally affected by the DWH oil spill in 2010. Sea turtle strandings in the Gulf of Mexico increased significantly since 2010 and have continued to rise since the BP oil disaster. More than 5,000 dead or weakened turtles washed ashore, or have been stranded, since the BP oil disaster. More than 460 sea turtles were found visibly oiled during oil spill response efforts and an unknown number died as a direct result of the disaster. ELB analysis provides fine-scale spatial data that can help identify sea turtle/shrimp fishery interaction hot spots. These data can assist managers in reducing the number of interactions and related sea t urtle mortalities through such means as time/area closures while potentially avoiding broad management measures like complete fishery closure. Shrimp fishing effort data recorded by ELBs are also a proxy for estimating red snapper bycatch mortality in the offshore shrimp fishery. Bycatch mortality estimates are important for determining whether management measures are needed to help red snapper populations exposed to oil recover from potential injury. The long-term effects of oil and chemical dispersants on shrimp species or their habitat remain unknown. Tracking the location and catch per unit of effort of shrimp can help scientists and fishery managers better understand trends in abundance and possible relationships between areas of low catch and oiled estuarine habitats. Expanding ELBs to the entire offshore fleet and making them available on a voluntary basis to a greater portion of the inshore fleet will improve the precision of sea turtle bycatch estimates needed to facilitate and track recovery of impacted sea turtle populations in the Gulf of Mexico. The recent increase in offshore shrimp fishing effort and potentially higher number of sea turtle interactions that could result also underscore the importance of ELBs in estimating sea turtle bycatch for developing mitigation and recovery strategies going forward. Description: Implemented through a joint reef fish/shrimp management plan amendment in February 2008, a statistically valid sample of shrimp vessel permit holders are randomly selected and must report shrimp fishing effort via an ELB. A simple ELB that records spatio–temporal fishing effort is currently used by approximately one-third of the federally permitted offshore shrimp fleet. Researchers have found these devices to be a reliable method for estimating sea turtle interaction and red snapper bycatch mortality in the Gulf of Mexico offshore shrimp fishery. NOAA has been making the ELBs available to members of the inshore shrimp fleet. A bout 150 inshore shrimp vessels use ELBs on a voluntarily basis. Upgrading this program to expand coverage in the offshore and inshore fleets will generate a wealth of fine scale spatial data. These data will allow scientists to better characterize the shrimp fishery's effort and classify overlapping areas of fishing effort in regards to sea turtle and juvenile red snapper habitat areas. Determination of where and when this fishery interacts with sea turtle and red snapper populations may allow more fine-scale management of the fishery (versus the need for broader management measures) while reducing bycatch mortality, which in turn would offset injuries caused by the oil spill and help affected populations recover more rapidly.		$6,650,000
	Lead By Example -- Use Non-Petroleum Motor Fuels to Prevent Future Oil Spills	Every ship, boat, truck, car and aircraft engaged in the response to this oil spill and all restoration activities to date have used vehicles powered by a liquid petroleum-based motor fuel. This fact is not only ironic, but symbolic of the fundamental challenge faced by Florida citizens who would prefer to not be a party to future oil spills. This restoration effort can, and should, demonstrate how the risk of future leaks, spills and releases of petroleum-hydrocarbons can be minimized, if not completely eliminated, by the use of commercially available natural gas and electric motor fuels in all types of vehicles. This action is relevant because, under current federal policy and industry practices, boaters and drivers in Florida have no choice but to purchase and use a liquid petroleum-based motor fuel to power all of their motor vehicles. Non-petroleum motor fuels, such as methane and electricity, are cheaper, cleaner and widely available, but are not easily used to power motor vehicles or boats. This means that restoration activities will contribute to the risk of a future oil spill and will do nothing to mitigate the risk of future spills. In effect, this contradicts Administration policy that instructs federal agencies to take action, where possible, to reduce petroleum consumption and reduce pollution created by the use of fossil fuels. When used to power motor vehicles alterntaive motor fuels, such as methane and electricity, completely eliminate the risk of hydrocarbon leaks, spills and releases from the supply chain and use in the vehicle; risk of petroleum releases are eliminated, both during routine operations and in the event of an accident. I propose to develop a program to advise recipients of monies under this program that use of natural gas and electric motor fuels in most types of vehicles is both technically feasible and, in many applications, commercially available from local vendors. Use of these fuels, however, requires education and behavior change. To change behavior I propose that specifications for funded projects that use of boats, cars, trucks and heavy equipment include the requirement that those vehicles be powered by a non-petroleum motor fuel when technically feasible. Natural gas and electricity is commercially available throughout the Gulf Region. Given sufficient demand, natural gas and electric motor fuels can be suppled to land or marine vehicles used to support administrative and restoration work. Many types of land vehicles powered by electricity or natural gas are commercially available; some of these vehicles operate in the Florida Panhandle today. Suppliers are standing by, waiting, for the opportunity to make these vehicles fuels available to help restore Gulf resources. Marine engines can be modifed to operate on natural gas; natural gas motor fuels can be stored on boats in either compressed or liquid form. There are no technical barriers to using natural gas to power boats; only perception. Natural gas retails at prices that are 50% to 75% cheaper than the price of gasoline or diesel fuel. Natural gas is now the fuel of choice for waste trucks, transit buses and other high-fuel consuming vehicles. In the marine sector, natural gas has become the fuel of choice for a variety of work boats, including harbor craft and ocean going ferry boats. Tampa Bay Watch operated a natural gas outboard 15-years ago. There are absolutely no technical barriers to the use of this non-petroleum motor fuel. The only barrier to the use of natural gas motor fuels is perception that this non-petroleum motor fuels is not practical or available; in other words, barriers are cultural, institutional and bureaucratic. Cultural, institutional and bureaucratic caused the Deepwater Horizon disaster; these are the very behaviors that these monies are intended to overcome. Widespread use of cheaper, cleaner, domestically produced natural gas and electric motor fuels and vehicles will create jobs, save consumer s money, stimulate local economies and break the market power of OPEC, thus enhancing the economic security of this Nation.		
	Gulf of Mexico Ecosystem Assessment: The Role of and Possible Oil Spill Impacts to Menhaden as a Keystone Species	Description: This multi-year, interdisciplinary research project would aim to clarify questions about the role of Gulf menhaden in the ecosystem and whether and how its population and ecosystem were affected by BP Deepwater Horizon oil. The resulting models and information could improve estimates of menhaden productivity and guide fisheries management decisions that bear on recovery of menhaden from any oil-related injuries. Link to Injury: Menhaden's offshore spawning and subsequent egg/larval drift into the estuaries in the northern Gulf coincided with the DWH oil disaster. Juvenile menhaden and oil would have been in the estuary at the same time. Therefore, it is likely that menhaden in one or more life history stage was exposed to the oil or chemical dispersants. Brown pelican and other species whose diets include menhaden were injured. Benefit and Rationale: An ecosystem assessment is needed to better understand the role and productivity of menhaden in the Gulf of Mexico and to what extent that DWH oil may affect the future health and ecological role of its population. Gulf menhaden is a significant part of Gulf of Mexico's base food web. Menhaden eggs, larvae, and young of-the-year are a major forage source for many economically important finfish. Upwards of 95 percent of the brown pelican's diet can be Gulf menhaden. The revenue generated by this fishery is of great economic importance to the Gulf of Mexico, especially to Louisiana. Recommendations made in an October 2011 stock assessment for Gulf menhaden provide an excellent starting point for the types of research needed for an ecosystem assessment. For example, the stock assessment recommends research to examine menhaden reproductive biology, predator/prey relations, genetics, and natural mortality through tagging studies. These studies are important components of an ecosystem assessment. Other: T The Exxon Valdez oil spill injured Pacific herring and pink salmon in Prince William Sound and like ly contributed to the long-term collapse of the herring population in that region. As a result, the Sound Ecosystem Assessment (SEA) project was designed to determine the root causes of their decline and elucidate the factors that driver their productivity. Between 1994 and 1999, the SEA program yielded an ecosystem level understanding of factors influencing juvenile pink salmon and Pacific herring survival in Prince William Sound. Multiple models were developed that better explained the relationships between such elements as the environment, predation and the associated food webs.		

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	ENHANCING OYSTER REEF RESTORATION IN COASTAL ALABAMA: OYSTER FARMING AS A RESTORATION MULTIPLIER	The core partners listed have formed a coalition to assist with and supplement any oyster restoration projects planned throughout the coastal waters of Alabama. Here we propose to contribute significant numbers of live oysters (both larval and post-set) to restoration projects throughout the coastal waters of Alabama, increasing the likelihood of success of restoration efforts, jump-starting oyster populations in these areas, and increasing the return on investment of restoration dollars. A secondary benefit of this NRDA restoration project will be the creation of environmentally, economically and socially sustainable jobs for coastal residents pursuing off-bottom oyster farming in Alabama, as well as provide outstanding educational opportunities at an area high school. Additionally, the oyster farming jobs will relieve fishing pressure on natural reefs. Public oyster reef restoration projects will be supplemented by seeding with larval and/or juvenile oysters spawned by the Auburn University Shellfish Laboratory (AUSL), raised by local oyster farmers, and in partnership with Alma Bryant High School¿s aquaculture program. Within 5 years, up to 10 billion oyster larvae and 100 million juvenile oysters could be added to public oyster restoration sites in the region. This supplemental restoration program will increase the likelihood of successful reef restoration by ensuring that oyster reefs are initially seeded with hatchery reared oyster larvae and then supplemented with juvenile oysters at each restoration site. While wild oyster set is expected and hoped for, successful oyster set is not guaranteed. Supplemental planting will provide two benefits. It ensures that the site has an initial population of oysters before competing species (e.g., barnacles, mussels) become established and preempt oyster settlement and decreases the time for oysters to reach sexual maturity. Additionally, supplemental stocking will help oysters become established in areas where larval supply may be limited (e.g., Bon Secour Bay) and will decrease the time to see a return on investment of restoration dollars. The enhancement of natural oyster reef structure and oyster abundance as early as possible will also provide critical `ecosystem services¿ through improved water quality, increased biodiversity and creation of more diverse habitat. In addition to assisting with the restoration of public oyster reefs, this project will provide an important boost to the development of off-bottom oyster farming in Alabama and other Gulf of Mexico states. The quantity of oyster larvae needed for this project can be readily produced at the Auburn University Shellfish Lab located on the campus of the Dauphin Island Sea Lab with upgrades in infrastructure (as was done with the Louisiana Sea Grant shellfish hatchery as one of Louisiana¿s early restoration projects). Production of juvenile oysters, however, requires the establishment of environmentally-friendly oyster farms. We propose to establish 2 100-acre oyster aquaculture parks (or 4 50-acre parks) in coastal Alabama, where watermen are paid to produce juvenile oysters to supplement oyster reef restoration. Over the long-term and when the restoration project ends we expect to see these farms continue and shift to producing adult oysters for the food market as an additional sustainable source of income through the operation of environmentally-friendly family farms. For this project the parks will support 40 independently operated 5-acre oyster farms each capable of producing 500,000 juvenile oysters per year per farm for restoration efforts. Combined the cooperative project with local famers would produce up to 20 million oysters per year for supplementation of restoration efforts. Additionally, 40 farms, once established, could raise oysters for premium half-shell markets, generating at least $5 million per year of combined income within 5 years through sales of premium oysters. Single choice oysters c ommand higher prices than those oysters traditionally produced from the oyster reefs in Alabama thereby providing greater income for the oyster producers and also reducing pressure on natural oyster resources by creating additional sources of income. Research in Alabama suggests that a 5-acre operation would allow an oyster farmer to raise 400,000 oysters per year; potentially yielding a gross annual income (with a conservative 80% survival) of over $80,000. This would be a significant increase in annual income for the typical oyster catcher who might currently earn $20,000/year. This project will also develop and implement an aquatic environmental education program for high school students throughout Mobile County. COASTAL Academy (Coastal Ocean Aquatic Science Technology And Learning Academy) will be centered around the aquaculture and marine biology programs located on the campus of Alma Bryant High School. Although the academy will involve all aspects of aquatic environmental sciences and coastal issues, the primary program focus will be on ¿Half-Shell High School¿, a program that will educate students and community members through the hands-on management and operation of an oyster farm, including restoration and biology projects, and the development of a curriculum that can serve as a model for the region. This combination of opportunities is a powerful means of engaging students, improving student knowledge, and, ultimately, student achievements and decision-making abilities. The emphasis on science, technology, engineering, and math education (STEM) and a hands-on, project-based learning system will be the core of ¿COASTAL Academy¿. STEM education will lead to students being able to pursue occupations that require similar skills that have been acquired in the Academy and prepare students for success in technical schools, and two- and four-year colleges. Total project budget of $13 million over 5 years broken into the following categories: -Juvenile oys ters for restoration projects, 20 million `spat on shell¿/yr for 5 years @ $20/1,000 for $400,000/yr or $2 million total -Assistance with initial permitting and surveying of oyster parks, for $1 million total -Eyed Oyster larvae (larvae that are ready to set) for restoration projects, 2 billion larvae/yr for 5 years @ $1/1,000 for $400,000/yr or $2 million total -Expansion of capacity and increase in storm-preparedness (building addition, larval tanks, generators, etc.) for Auburn University Shellfish Laboratory as a resource for oyster restoration, for $2.5 million total -Oyster gardening program to expand restoration capabilities and increase community involvement, for $50,000/yr for 5 years or $250,000 total -Oyster restoration assistance and educational program development at Alma Bryant High School¿s aquaculture program (Bayou la Batre), for $250,000/yr for 5 years or $1.25 million total -Oyster restoration assistance and educational program development at Sea, Sand & Stars (Orange Beach), for $100,000/yr for 5 years or $0.5 million total -Program funds for state agencies for management of and assistance to restoration projects and aquaculture oversight, for $2.5 million total -Monitoring and technical assistance provided to partners by Auburn University Marine Extension & Research Center, for $200,000/yr for 5 years or $1 million total	Mobile,Baldwin,Jefferson	$13,000,000
	Development and Distribution of Gear Technology to Improve Fuel Economy and Reduce Bycatch in the Gulf Shrimp Fishery	The offshore shrimp trawl fishery accounts for a significant portion of landings in the Gulf of Mexico. Due to a multitude of events (i.e. hurricanes, oil spill, imports), the fishery has seen a substantial decline in fishing effort while operating costs have continuously risen. With increasing fuel prices, fuel saving technologies are a logical avenue to assist in reducing operating expenses. A paucity of information exists documenting the effect of gear technologies on fuel consumption. Cambered trawl doors are currently being utilized by some fishermen in the southeastern United States. These trawl doors have evolved significantly over the past decades, but until recently have not received much attention in the southern shrimp fishery. Evaluations of these doors have yielded promising potential to reduce fuel consumption in the shrimp fishery. Several door sizes have been evaluated, but cambered trawl doors, 50% smaller than the traditional wood or aluminum doors, are documented to have fuel savings of 25-30% during actual fishing conditions. Additionally, bycatch reduction remains a high priority issue in the southeast. Reducing incidental bycatch has been shown to improve catch quality and reduce fuel consumption. We propose to conduct a series of experiments aimed at documenting the fuel savings achieved by cambered trawl doors and continue to improve the bycatch reduction capability already in use in the fishery. More specifically we aim to: 1) Evaluate cambered door gear technology within the southeastern shrimp trawl fishery; 2) Continue to elicit industry participation in evaluating more complex bycatch reduction devices (BRDs); and 3) Conduct result demonstration and dissemination activities of the newly documented gear (doors & BRDs) to shrimp fishermen throughout the southeast to increase the acceptance and use of these gears. Through years of experience, we have found that informal meetings are an optimal forum for information dissemination; providing less volatility from industry and allowing for an effective one-on-one exchange of ideas. As such, we will convene a series of informal meetings throughout the southeastern US to disseminate the results of this study. By continuing our research and development efforts to reduce bycatch within the shrimp trawl fisheries, commercial fishermen will become actively involved in BRD research and development and will be more accepting of those devices tested.		$1,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Multi-Function Vessel -- Aquatic Weed Harvester, Marine Trash Skimmer, Oil/Muck Dredge	Detailed Features - Proposed Multi-Function Vessel The multi-function vessel design for applications in the Gulf Coast Wetlands will be basically that of Alpha Boats Unlimited (ABU) Aquatic Weed Harvester(s) and/or Trash Skimmer(s)-(refer to ABU's website: http://www.alphaboats.com)...modified to contain the following features: 1. The HULL will be a "Mono Hull", rather than the traditional & conventional twin pontoon units previously designed and built for Aquatic Weed Harvesters & Trash Skimmers. Considering the added weight of larger engines, added fuel capacity & specially designed operating features necessary to deal with a wide variety of debris & materials anticipated to be found in the wetlands, they will be larger, more effective and able to be deployed in shallow wetland waters. 2. Rather than using paddle wheels for propulsion and steering, this unit would be equipped with a set of light weight individual rubber "twin tracks" (much like those used on "tanks"), each equipped with flights and each positioned along and outside of each side of the Mono Hull. We feel that traditional paddle wheels and propellers (which could cause "blowholes") are too restrictive to be as versatile as we wish, for this concept. Each "track" could be individually (and independently) raised and lowered (hydraulically) to enable these shallow-draft vessels to continue operating in "mud flats" when floating or when the hull bottoms out as the tide "goes out". The modifications to ABU's standard Aquatic Weed Harvester (and Trash Skimmer) would basically entail enlarging the Mono Hull to deal with the added weight of tracks, a larger higher horsepower engine (w/ sufficient HP to operate all systems), sufficient hydraulic pumping systems (to operate all systems), additional fuel capacity, increased debris load, the addition of an all-weather, 2-man cab (operator + 2nd person for safety reasons) w/ heating & air conditioning (able to operate in all seasons & under all weather conditions), etc., plus fabricating the Mono Hull pontoons of stainless steel (instead of a conventional steel hull with zinc anodes as an option) to deal with the salinity of the tidal water. Obviously, when the tide goes out, the tracks, which would be individually reversible and have variable speed in both directions, would take over both precise steering and propulsion when the hull bottoms out. 3. The "multi-function" unit will be equipped with INTERCHANGEABLE/COMPATIBLE "HEADS" with "universal" mechanical connections to the main front lifting conveyor + quick-connect hydraulic connections to supply power to these systems, and with the capability of: a) harvesting aquatic vegetation and recovering floating trash & debris, plus b) the ability to mechanically & hydraulically dredge "oily muck" in the weed infested wetland areas' designed with a horizontal hydraulically powered auger-cutter (w/ left & right auger flights) to move materials from sides to the center head mounted slurry pump...to move the material to a barge or shore disposal site, the auger will be shrouded to confine turbidity and equipped with cutting bars to chop vegetation into pieces small enough for pumping. c) accumulate "oily water" liquids (both drainage and/or disposal) that will undoubtedly drain through the on-board storage areas on both the weed harvester(s), trash skimmers and/or the transport barges during operations. d) high pressure hosing systems to enable clearing of mud, weeds & debris from under permanently rooted vegetation and/or trees or plants. 4. OTHER CONSIDERATIONS: There is also the possibility of equipping the vessels with a twin propeller, hydrostatically-driven system for moving quickly back and forth from work sight to offloading sites. The prop systems would operate independently of the side mounted "track" systems and be able to be raised & lowered in order to get them out of the water when pulling out on land. Also, the units will be able to independently operate in both direction & speed, allowing for easy and precise maneuverability. NOTE: Both the "twin-track" and propeller systems, combined with the different "heads", will enable precise (horizontal & vertical) cutting and/or removal of materials. SUPPORT EQUIPMENT: Both the Harvesters & Trash Skimmers will have compatibly sized Support Equipment ("click" on the photos on ABU's homepage, http://www.alphaboats.com) to enhanced performance: a) Shore or Pier Conveyors - for offloading weeds at shorelines (down embankments or over a pier). b) Transport Shuttle Barges - to transfer weeds (or debris) from multiple Harvester(s) or Trash Skimmers while out in the water, thus eliminating non- productive round trip down time, should these vessels have to go back & forth to shore to offload recovered materials. c) Transport Tilt-Deck Trailers - to launch & retrieve Harvesters & Trash Skimmers, & haul them over the highway from site to site. It is anticipated that the final design, even with an enlarged Mono Hull, will still enable the vessels to be easily launched and retrieved (on a ramp or at shorelines) and transported over the highways, which will be advantageous in flexibly designating its usage to high priority locations. With 100's of pieces of these types of equipment in operation worldwide modification of the special Weed Harvester (or Trash Skimmer) unit(s) with interchangeable "heads", modified hulls, the addition of tracks and a larger diesel engine, etc., will not be a major undertaking.	To be determined by BP	$1,500,000
	Marsh/Shoreline Remediation & Restoration	Our solution for remediation, restoration and recovery is a holistic offering. In the plan, we include berm stabilization and sustainable, natural land building. Marshlands remediation and stabilizing are part of our plan. Our solutions include "dead zone" control. Our plan addresses pressing needs of: Fishing Industry (generally and specifically) Ecological Systems Marine Habitats and we include a variety of services to other stakeholders. Our plan works sustainably because we cooperate with nature, applying services, techniques, product, and Gulf Coast experience. Materials: USACE approved "biodegradable units" (24' x 28') filled with RZHO blends which absorb and adsorb hydrocarbons. In the approved containers, RZHO microbial values continually protect plant life, joining forces with existing in-situ decomposers. The "biodegradable units" are plugged with native marsh grasses and trees. The RZHO protects the sensitive pneumatophores of black mangrove to allow survival, should they be subject to contamination. Methodology: Units are strategically placed along shorelines at the water line, stabilized to endure tidal dynamics. The high performance grasses and trees are able to stand strong, owing to the physical design of the containers and the container content. In some areas of deployment, we use biodegradable stakes which maintain strength and hold for several months, allowing strong rooting and grow-in for the plants. With a 100% of proven growth.	Lafourche,Plaquemines,Hancock,Jackson	
	Project Space Mop	There are still vast underwater plumes of oil in the gulf to this day, killing everything in their path as they migrate around. These plumes are vast in size, and should not be underestimated as to their continuing devastating effect on gulf wild-life eco-systems. The remaining oil in the gulf needs to be completely accurately mapped using NASA satellite imaging and environmental deflecting technology. With accurate maps in hand, then crews need to be dispatched to go underwater with long siphons and siphon up the oil plumes to waiting tankers that will take the oil ashore for reprocessing. This reclaimed oil can be used to help fill the national strategic oil reserve and help to drive the price of fuel down a bit.. Once the oil is all "mopped up" then biologists can go into the areas that were saturated and assess the true environmental damage and remedies.		$200,000,000

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	Louisiana Wetlands Redux	Coastal Erosion Abatement and Wetland Remediation Gary Holland Gary Holland Louisiana Wetlands Redux Project The post-Civil War era brought about the creation of The U.S. Army Corps of Engineers and their initial efforts to gain control of The Mississippi River. Through the building of massive levee systems, the Mississippi River no longer overflowed it's banks during the seasonal Spring river floods and was contained within the built-up, higher banked and levied channel. During this era, the advancement of ship powering transitioned from wind, to steam, to diesel, within a few decades. This advancing technology gave rise to larger ships requiring deeper and deeper drafts. Corps Engineer, Robert Eads, responded to the necessity of deeper water and clear passages with the design of a jetty system at the River's mouth. The natural delta mouth no longer slowed the River's current and the jetty kept the nutrient rich sediments not only within the River's channel but now, held these sediments in suspension into deeper waters, requiring less dredging not only in the River channel but at it's terminus at The Gulf of Mexico. This engineered system literally turned off the spigot for Louisiana's natural land building, losing rich sediments which had naturally maintained the now diminishing delta. Tidal, wave action and storm erosion of The Louisiana Marsh Coastline ensued. This exposed entire habitats, ecosystems, and a growing human population to an increasing danger by the uncontested onslaught of Gulf waters. The results of this manipulation of River flood control along with the advent of pumps to drain the marsh increased the attraction to the New Orleans basin for development. This dependence on fabricated structures and systems allowed for a false sense of "safety" from flooding. Technological changes weren't limited to River transportation as The American Industrial Revolution demanded increasing oil exploration in So. Louisiana, resulting in the dredging of thous ands of miles of new "coastline" to accommodate pipelines that carried drilled oil and natural gas to refineries and shipping depots throughout the Louisiana marshland. This action resulted in creating more erosion prone shoreline and allowed for the inundation of saltwater into habitats naturally established to flourish in fresh and brackish water conditions. The result was the accelerated death and loss of marsh grasses, Swamp Cypress and all marsh flora and fauna due to this salt-water invasion into the swamp eco-system. The object of the Louisiana Wetlands Redux Project is to stop Mississippi Delta erosion and allow the river system to rebuild land in a restored, natural methodology. We will accomplish this rebuilding of wetland area through the deployment of collapsible concertainers, lined with heavy-duty, degradable fabric and filled with locally available, dredged sediments, with the eventual development of a pipeline to deliver these sediments, pumped in place from the on-going dredging at the mouth of The River. The Louisiana Wetlands Redux Project will use stable barriers in concert with other proven successful applications and configurations to make use of these dredged sediments for fill material, abate the ongoing erosion and begin natural land-building processes and wetland remediation. These structures will be distributed initially at the most "at risk" sites and provide necessary feedback for future in order to develop ever more successful application. These concertainers will be constructed, lined and put in-place all by a local workforce. The Project will focus close attention to allowing natural tidal ebb and flow and the egress of bayou waters with a system, which will allow natural water movement. Louisiana Wetlands Redux are consulting with botanists and etymologists along with our lead scientists to determine how these new sediments will be best planted yet we already know the black mangrove, swamp cypress and marsh grasses will play integ ral roles, thus establishing a robust rooted and biologically active habitat where there is now open water. This Project will create new training and jobs for our Coastal Parish Boat Captains, their boats, equipment and crews, who have lost not only revenue due to storm surges from Katrina's devastation as well as threats from the BP DWH-type catastrophes. Louisiana Wetlands Redux will also help restore a proud heritage and culture of watermen and women, unique to The Louisiana Wetlands environment. Our project will enable our watermen and women to return to their heritage of working in the swamp and marsh which will be empowering as they actively stop the erosion processes and regain lands lost from over a hundred years of unabated erosion and neglect. We will form a frontline barrier to stop pollutants from reaching delicate coastal marshlands and use a variety of microbial treatments should any toxins reach our barriers. This system will also be used to rebuild the vanishing barrier islands. Our system has the capability to also rebuild our lost oyster reefs by using oyster shells as fill in the concertainers, which the oyster "spat", will attach to and begin rebuilding their own reefs. We would request a test area of coastal wetland shoreline to evaluate the most effective implementation of these applications and a "fleshing out period" to develop the most efficient methodology based on the varied coastal conditions All systems will be assembled, distributed and disembarked at "on-site" locations along with manufacturing for seaward facing bric-a-brac material which ensures less undercutting thus employing a varied and voluminous workforce to sustain this on-going project. The Implication: The implication going forward with this systemic application would cause a cessation of the current land erosion, the creation of a land building process starting immediately and accelerated land building over time. This plan incorporates the redeployment of local B oat Captains, boats, equipment and crew members who will be put back to work in the environment they are accustomed. These men and women would now be working to save and recreate habitats for creatures great and small during this long-term construction. Our workers will help save lives in the process as the barrier walls would continue to expand farther and farther outward from of the recovered shoreline and immediately protect this delicate habitat which is now defenseless to the inundation of both naturally occurring and man-made erosion and catastrophic toxins. The land-building properties of this, The Louisiana Wetlands Redux Project, will ensure more and more safety for not only the growing human population of the Louisiana Coastline but also the marsh habitats and estuaries against storm surges through the rebuilding of a sustainable landmass which will match the coastline of Louisiana's pre-Civil War shoreline. Gary Holland Director Louisiana Wetlands Redux 2266 Glastonbury Road Westlake Village, CA 91361 Phone (818)-489-9819 Email- drdaddyeaux@mac.com	St. Bernard	$750,000
	Quantitative Fish and habitat assessment and monitoring, using scientific acoustics	A suite of tools that can be used from virtually any vessel of opportunity for collection of acoustic data and analysis software for assessment of substrate and habitat characteristics - as well as fish abundance and distribution in deeper waters. The BioSonics DT-X Digital Scientific Echosounder system is used for quantitative assessment of substrate class, submersed aquatic vegetation (SAV; location, density, canopy height), and fish biomass (distribution and quantity). The calibrated, portable system can be deployed from virtually any vessel and data can be analyzed by trained personnel to provide unbiased, quantitative assessment of biological and physical environmental variables. BioSonics provides hardware, software, training, support, and technical services. Clients include NOAA/NMFS, Bureau of Reclamation, Tribes, Universities, and private consultants. Additional information available on web site.		$45,000
	GULF OF MEXICO HATCHERY AND FISHERIES RESTORATION CONSORTIUM	Problem: The Deepwater Horizon Oil Release (DWH) caused environmental and economic damage to fisheries in the northern Gulf of Mexico. America must employ novel and effective approaches to restore both economic and environmental wellbeing of the affected fisheries. In addition, habitat destruction caused by hurricanes and other man-made causes (over-fishing, erosion and spills) have led to significant decrease in Gulf fish populations during the last decade. Solution: Marine aquaculture of key species can be employed to restore fisheries through restocking and to restore economic vitality through technology transfer and stimulation of small businesses resulting in job creation. This effort should be highly collaborative involving institutions in all five Gulf States as well as other national and international institutions, public and private, with significant hatchery technologies. Implementation Team: Gulf of Mexico Hatchery and Fisheries Restoration Consortium. - Gulf Coast Research Laboratory/University of Southern Mississippi (GCRL; lead institution) - University of Texas Marine Science Institute (UTMSI) - Louisiana University Marine Consortium (LUMCON) - Auburn University (AU) - Mote Marine Laboratory (MML) - University of Maryland- Baltimore (UMB) These institutions are leaders in marine aquaculture and stock enhancement research, implementation, and technology transfer for the northern GOM. The consortium is built on established relationships and will employ the highest quality science and economic approaches to implement, and transfer the technology to raise significant numbers of fish for fishery restoration and to stimulate private sector small business development. In addition to the implementation team, the consortium has established scientific, governmental agency and commercial advisory teams. Implementation Plan: The technology for aquaculture and fishery restoration of marine fish varies among species. This necessitates the collaborative invo lvement of these 6 leading institutions that have conducted research on over 10 of the most economically and ecologically important Gulf fish species. Among the species are those for which the technology to implement stocking, technology transfer, and business stimulation already exists. The species targeted for immediate implementation of stocking and technology transfer include Red Drum, Spotted Sea Trout, Red Snapper, White Shrimp, Bull Minnows, Croaker, Florida Pompano, Cobia, Greater Amberjack and Southern Flounder. Projected Results: The work of the consortium will result in advanced technologies for use by Gulf States fishery agencies and private industry. Similar efforts in the Mediterranean Sea led to a $1 Billion industry in 10 years. The 2007 NOAA aquaculture plan projects 75,000 jobs created for every million tons of seafood produced by aquaculture. It is estimated that aquaculture of Gulf fish species would double the seafood output of the Gulf of Mexico ($700 Million in 2008). Additionally the recreational fishing industry (>$12 Billion in 2008) would realize expanded employment and business opportunities as natural populations are restocked with hatchery produced fingerlings.		$60,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Treat Subsurface Contamination	In wetlands, oil exists below the surface of the sediments. Inject MicroSorb microbes into subsurface to degrade oil. Below beaches, oil is floating on the groundwater. With horizontal drilling, injection wells and recovery wells can be placed. Inject MicroSorb microbes with seawater into the injection wells. Mobilize the oil and recover oil in recovery wells. Separate oil and use recovered water to mix with microbes and inject into injection wells. If there are still oiled oyster beds, install parallel aeration systems on each side of the bed. Inject MicroSorb microbes onto the beds. The aeration systems will supply oxygen to the microbes and improve the growth of oysters. The microbes will destroy remaining oil. In deep water where there are plumes on the seabed, install an aeration system and apply MicroSorb microbes. MicroSorb Environmental Products, Inc. is in part owned by Oppenheimer Biotechnology, Inc. The Oppenheimer Formula was the best microbial product in the BP Biochem Strike Team Report on NCPPL products conducted by Dr. Portier of LSU. The Oppenheimer Formula is capable of destroying PAHs as well as light ends in crude oil. I have a patent pending on subsurface aeration systems. Oil in sediments, on oyster beds and in subsurface plumes can be treated and destroyed more quickly than nature can provide. If you would like more information, please contact me. William E. Baird, PE MicroSorb Environmental Products, Inc. 104 Longwater Drive, Norwell, MA wbaird65@aol.com		
	Shoreline, Marsh Restoration and Recovery	Install RZHO filled TECH Units with grass and trees Includes all labor, equipment, insurance and management. Completed Projects: Project location: Pass a Loutre Louisiana - Technical design advisory and provider of RootZone Humus blend RZHO for GS Bags (special container fill & consultation as to scientific accuracy of specific oleophilic microbes and ecological correctness/safety of container contents and container materials) (latitude: 29.069608, longitude: -89.230950). Mississippi coastal restoration projects which include shore areas from Pass Christian, MS to Ocean Springs beach and inland coastal areas. Projects in Hancock, Harrison, and Jackson Counties of Mississippi. Chief Scientist John Wear, Trident Environmental Services & Technologies, Inc., serves as lead consultant, designer, advisor for the Mississippi projects and developer of methods which ensure bioremediation and vertical accretion for marshlands plant growth, with strong root development and nature-cooperative land building that includes tidal and river flow sediment capture.		
	Chenier Ronquille Barrier Island Restoration Project	Located within the Barataria Basin of Plaquemines Parish, Chenier Ronquille Island is approximately 11,600 linear feet along the Gulf of Mexico shoreline. The sandy beach face is very narrow thus exposing the back-barrier marsh to increased erosion and deterioration. This segment of the barrier island chain suffers some of the highest shoreline retreat rates in the nation. Given the loss of shoreline integrity, several breaches have opened which has resulted in discontinuous marsh and development of large open water areas. Due to the dilapidated state of the island and inadequate supply of sandy sediment, natural processes continue to result in a net loss of sediment and subaerial acreage. Through a partnership between NOAA and the State of Louisiana, this project is currently under design to restore back barrier marsh habitats and protective dune using offshore borrow material. This project compliments several existing barrier island projects that together are reestablishing Louisiana's barrier island system, which in part serves as a first line of defense against storms. The design includes 2.69 MCY of sediment to be mined from borrow areas offshore (see attached map), including a marsh platform to be constructed to approximately +2.0 ft NAVD88. Native herbaceous vegetation and dune stabilizing fencing will be installed post-consolidation of the fill sites. The initial fill site is 411 acres above 0.00 ft NAVD88. This preferred design alternative maximizes the marsh platform while providing the minimal footprint of protective dune necessary to protect the back marsh for the projected life of the project. NOAA has partnered with the State of Louisiana for over twenty years through the Coastal Planning, Protection, and Restoration Act (CWPPRA), and has long supported and provided technical expertise into the design and reconstruction of barrier islands. The design and hydrodynamic modeling that is part of this project has taken into consideration the multiple factors contributing to project performance, including long-term storm probability and associated wave heights. Because of the modeling involved with determining an optimal design, coupled with prior experience conducting this type of restoration in Louisiana, NOAA is confident that this project is feasible and likely to accomplish trustee goals.	Plaquemines	$35,000,000
	Pelagic Longline Fishing Vessel and Permit Buyback in the Gulf of Mexico	The Gulf of Mexico is the only known spawning area for the western population of Atlantic bluefin tuna and the Deep Water Horizon spill occurred at the peak of the spawning season covering approximately 20% of the historic spawning area. The Gulf is home to dozens of other marine fish and wildlife that were impacted by the spill. All of these species are impacted by the pelagic longline (GOM PLL) fishery which encounters approximately 80 non-target marine species, including endangered sea turtles, and depleted sharks, bluefin tuna, and billfish. Government catch data from 2007-2009 indicates the fishery killed 43,245 non-target animals, including 6,009 lancetfish, 5,844 dolphinfish, 2,747 escolar, 1,745 sharks and rays, 858 wahoo, 794 billfish (marlin, sailfish, spearfish), 612 bluefin, and 169 bigeye tuna, and interacted with 137 leatherback and 17 loggerhead sea turtles. Actual mortality is much greater as only an average of 22% of the hooks set were observed, e.g., an estimated 423 bluefin are killed annually. A voluntary vessel and permit buyback program for the GOM PLL fleet would, depending on participation, significantly reduce the mortality caused by the fishery and help mitigate spill damage to bluefin and other finfish. To spur participation, establishment of a gear transition program would provide remaining PLL fishermen with funding and training to switch from PLL to green stick and swordfish buoy gear which would allow fishermen to continue targeting yellowfin tuna and swordfish, while significantly reducing bycatch mortality of other species. Finally, new rules to prohibit the use of PLL fishing gear in the Gulf would ensure that surface longlining does not return and negate the biological benefits achieved through a buyback and gear transition. The cost of a complete buyout of the fishery's 84 vessels and permits will depend on the structure of the buyout program. The environmental benefits of eliminating all PLL fishing in the GOM are more stra ightforward to calculate. According to government data, more than 14,415 animals would be protected annually by eliminating PLL; including overfished, protected, and otherwise depleted marine species, including 50 leatherbacks, 6 loggerheads, 552 sharks, and 265 billfish. Ending this source of mortality will promote the recovery of these and other animals that suffered injury because of the oil spill. This concept enjoys the support of PLL fishermen, recreational anglers and environmentalists.		
	Increase the pace, quality and permanence of voluntary land and water conservation through the Partnership for Gulf Coast Land Conservation	The Partnership for Gulf Coast Land Conservation project The Partnership for Gulf Coast Land Conservation (PGCLC) is a new coalition of local, regional state and national land conservation organizations devoted to advancing land and water conservation in the Gulf of Mexico region. This initiative is organized under the auspices of the non-profit Land Trust Alliance (Alliance) and is patterned after other successful land trust coalitions across the country. Today our membership consists of 25 national, regional and local land trusts operating in the Gulf States. The Partnership's mission is to work together across the five Gulf of Mexico states to increase the pace, quality and permanence of voluntary land and water conservation in the coastal region. Land trusts are community-based non-profit organizations that work with landowners to permanently conserve forests, rivers, farms, ranches and other natural areas critical to a sustainable environment and healthy, thriving communities. Through this project, the Partnership proposes to: 1. Increase the effectiveness and efficiency of land trusts in the Gulf Region. 2. Develop and promote a public policy agenda which will reduce the barriers to private sector conservation efforts and increase funding for acquisition and restoration. 3. Develop collaborative projects that will enable the land trust community and supporters to implement landscape scale conservation measures in the region. Collaborative projects may be built around water quality, critical habitat, or other criteria. 4. Participate in landscape-scale conservation planning in collaboration with other conservation partners (resource agencies and other non-government organizations) that prioritizes habitat for endangered and threatened species, improvements to water quality, connectivity to other protected lands, trust resources and important cultural and recreational features. 5. Participate in and coordinate our efforts with other ong oing conservation planning and implementation activities through entities such as the Gulf of Mexico Alliance and the Gulf of Mexico Foundation and others.		$1,000,000
	Pelican Island Restoration Project	This project will restore the key Brown Pelican and other waterbird nesting islands in Barataria Bay, Louisiana, that were worst affected by the oil spill. The project will use heavy machinery to place rock riprap around the eroding islands, and to fill this with dredge material to secure the islands and expand the amount of bird nesting habitat. The project will be implemented in partnership with the locally-based Barataria Terrebonne National Estuary Program. A virtually identical project carried out to restore the nearby Queen Bess Island in the early 1990s was hugely successful and that island has since withstood hurricane Katrina and still has all the key bird nesting habitat intact (see: http://lacoast.gov/reports/pr/ba19prg2.pdf).	Plaquemines	$2,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Delacroix Island Protection and Restoration: A Hurricane Protection and Community Resilience Project	Proposed by Land Trust for Southeast Louisiana to Louisiana NRDA November 17, 2011 Delacroix Island or Delacroix is an unincorporated town in St. Bernard Parish, Louisiana, United States. Land Trust for Southeast Louisiana proposes to use NRDA restoration funds to: 1. acquire (through fee simple purchase) nearly 1300 acres of marsh beginning at the confluence of the western bank of Bayou Terra Buffs and the southern bank of Bayou Gentilly 2. perform baseline assessments, develop and implement an Ecological Restoration Plan following standards set forth by Society for Ecological Restoration 3. manage and monitor the property in perpetuity to maintain conservation and restoration values as set forth in the Plan HISTORICAL OVERVIEW OF DELACROIX AND PROJECT NEED In the 1780s, Spanish Canary Islanders, or Isleños, settled in the area after being given land grants from Spain. After selling their land grants to the planters, the Isleños frequently worked on the plantations they helped to create. Some began to resettle in the easternmost reaches of St. Bernard parish around the 1820s resulting in the firm establishment of Delacroix Island fishing community before the Civil War. By the 1900s, Yscloskey, Louisiana and Shell Beach, Louisiana near Lake Borgne were thriving communities. Seafood harvested by these fishermen in the 1800s and 1900s supplied New Orleans restaurants with a seemingly inexhaustible supply of shrimp, fish and crabs. Previously connected to the outside world by boat, in the 1930s a road was constructed to "the island" (in reality an inland area surrounded by marsh and bayous). Since the 20th century, Delacroix has been regionally famous for fishing and trapping. Like much of the region, Delacroix was devastated by Hurricane Katrina and its storm surge in 2005. The entire area was flooded, and the majority of buildings completely destroyed. Also destroyed was much of the area's fishery along with commercial and recreational fishing fleets, seafood and fuel docks. By 2010, much of this fishing town had been reconstructed, with most new construction elevated high on piers. The fisheries however, took another devastating blow April 20, 2010 with the explosion of Deepwater Horizon which drilled on the BP operated Macondo Prospect. From this point forward the lives of many of those families that had for generations reaped the bounties of seafood in the waters of Southeast Louisiana, would be changed forever. The spill caused extensive damage to marine and wildlife habitats and to the Gulf's fishing and tourism industries. Skimmer ships, floating containment booms, anchored barriers, sand-filled barricades along shorelines, and dispersants were used in an attempt to protect hundreds of miles of beaches, wetlands, and estuaries from the spreading oil. Scientists also reported immense underwater plumes of dissolved oil not visible at the surface as well as an 80-square-mile (210 km^2) "kill zone" surrounding the blown well. In late November 2010, 4,200 square miles (11,000 km^2) of the Gulf were re-closed to shrimping after tar balls were found in shrimpers' nets. The amount of Louisiana shoreline affected by oil grew from 287 miles (462 km) in July to 320 miles (510 km) in late November 2010. In January 2011, an oil spill commissioner reported that tar balls continue to wash up, oil sheen trails are seen in the wake of fishing boats, wetlands marsh grass remains fouled and dying, and crude oil lies offshore in deep water and in fine silts and sands onshore. A research team found oil on the bottom of the seafloor in late February 2011 that did not seem to be degrading. On May 26, 2011, the Louisiana Department of Environmental Quality extended the state of emergency related to the oil spill. By July 9, 2011, roughly 491 miles (790 kilometers) of coastline in Louisiana, Mississippi, Alabama and Florida remained contaminated by BP oil, according to a NOAA spokesperson. In October 2011, a NOAA report shows dolphins a nd whales continue to die at twice the normal rate. PROPOSED SCOPE OF WORK The Delacroix Project is designed to protect and restore 1300 acres that will: - fortify hurricane protection for the town of Delacroix; - enhance community resilience; - improve wildlife habitat, especially waterfowl; - improve estuarine habitat essential to early life stages of commercial and recreational fishery; - create jobs for local residents, especially those related to duck hunting and fishing habitat for sportsman worldwide; - enhance nature-based tourism opportunities. The project calls for fee simple purchase of nearly 1300 acres of marsh beginning at the confluence of the western bank of Terre Aux Boeufs and the southern bank of Bayou Gentilly. This land mass represents the remaining land barrier for the town of Delacroix from south and western tidal surge. Land Trust for Southeast Louisiana has negotiated a "bargain sale" which means that the owner will sell the property below appraised value and contribute the difference as match for grant program funding. Two events in recent history have caused some habitat loss on the property: a fire along the ridge adjacent to Terre Aux Boeufs caused significant loss of live oaks and other hardwoods shortly after Hurricane Katrina. Hurricane Katrina also caused physical damage to the western marsh of this property bordering a waterway known as the Graveyard. An aggressive Ecological Restoration Plan would be developed and implemented once the land is purchased. The Plan would include: - reforestation of live oak, associated hardwood species and cypress - shoreline restoration on the property's western boundary would include soil replacement and planting of native grasses LTSL will utilize its volunteer base as well as partnering with both state and federal governmental agencies and other NGOs to insure both success and compliance. Once the project is completed the town of Delacroix will have a restored and healthy landm ass for future hurricane protection, enhanced community resilience and a continued economy sustained by commercial fishing, sports hunting and fishing and nature-based tourism. About the Land Trust for Southeast Louisiana: The Land Trust is a 501C3 that works with community partners to create a healthy and sustainable natural environment by conserving and protecting valuable natural areas and agricultural lands of southeast Louisiana. We preserve ecosystem and landscape values through conservation easements, land acquisition and community engagement. The way we choose to conduct our business is clear: we build meaningful relationships with landowners and citizens in our service area by adhering to core values: - Commitment to "in perpetuity" - Community: working collaboratively - Decision-making through consensus - Integrity - Respect for the rights of individuals, private property owners and government regulations - Sustainability LTSL is a member of the Land Trust Alliance; we are guided by its national standards and have included LTA accreditation in our strategic plan. We are committed to "in perpetuity" as the bar for LTSL financial planning and legal authority to manage lands and easements.	St. Bernard	$1,200,000
	Louisiana Reef Restoration	Approximately 85% of the world's natural oyster reefs have been lost, while the remaining natural reefs are considered the most imperiled marine habitat on earth. Although oyster reefs in the Gulf of Mexico are characterized as being in "fair" condition (50-89% lost), the loss of ecosystem services has nonetheless been significant. Complete elimination of oyster reefs, or reduction of height and structural integrity of remaining oyster reefs, has contributed to increased wave energy and shoreline loss in many of Louisiana's productive bays. Additionally, the loss of structurally complex oyster reefs has significantly reduced available habitat used for foraging and refuge of a number of recreationally and commercially important fish and invertebrate species. This project will create approximately 74.8 miles (more accurate that the estimate of 91 miles given on this site) of substrate upon which oyster larva can attach, grow, and reproduce. The three locations of these reefs are the Biloxi Marshes in St. Bernard Parish, sites at the northern and southern end of Barataria Bay, and two locations in Terrebonne Bay. In Louisiana, TNC has installed nearly three miles of artificial oyster reef and is currently building just over an additional mile along coastal shoreline as part of three proof-of-concept projects. These projects, located in Vermilion and Barataria Bays and the Biloxi Marshes, began in 2010 with the goals of demonstrating oyster reef viability, coastlineprotection/accretion, fisheries response, and cost effectiveness. These projects are rigorously monitored with a standard protocol that allows for cross-project comparison. Constructed reefs are growing oysters and reducing wave energy reaching the shoreline; initial observations indicate that sediment is beginning to accrete between the reefs and shoreline. The requested funding would allow for the construction of 74.8 additional miles of oyster reef, which would enhance estuarine productivity and protec t hundreds of acres of coastal marshes. Given that we will be using proven technologies and contractors have significant unused capacity to take on projects of this scale, actual deployment of reef structures could begin within six months of notification of funding. Existing reef monitoring programs could be expanded to include a subset of reefs constructed through this funding. Artificial oyster reef installation in Louisiana Cameron,Terrebonne & St. Bernard Parishes, LA protection/accretion, fisheries response, and cost effectiveness. These projects are rigorously monitored with a standard protocol that allows for cross-project comparison. Constructed reefs are growing oysters and reducing wave energy reaching the shoreline; initial observations indicate that sediment is beginning to accrete between the reefs and shoreline. The requested funding would allow for the construction of 70 additional miles of oyster reef, which would enhance estuarine productivity and protect hundreds of acres of coastal marshes. Given that we will be using proven technologies and contractors have significant unused capacity to take on projects of this scale, actual deployment of reef structures could begin within six months of notification of funding. Existing reef monitoring programs could be expanded to include a subset of reefs constructed through this funding. Oyster reefs were one of the most affected near-shore marine resources as a result of the spill. This project proposes to significantly increase the amount of oyster reef habitat while simultaneously providing important marsh and fisheries benefits. The proposed project would place artificial oyster reef/shoreline protection projects in five coastal parishes: St. Bernard, Plaquemines Jefferson, Lafourche and Terrebonne. The Biloxi Marsh portion is proposed as a significant expansion of the Conservancy's existing reef restoration project and all locations will protect strategically important coastal islands and marshes that serve as a first line of defense for interior marshes and uplands in all five parishes.	Terrebonne,Lafourche, Jefferson,Plaquemines ,St Bernard	$77,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	GULF OF MEXICO HATCHERY AND FISHERIES RESTORATION CONSORTIUM	GULF OF MEXICO HATCHERY AND FISHERIES RESTORATION CONSORTIUM Problem: The Deepwater Horizon Oil Release (DWH) caused environmental and economic damage to fisheries in the northern Gulf of Mexico. America must employ novel and effective approaches to restore both economic and environmental well being of the affected fisheries. In addition, habitat destruction caused by hurricanes and other man-made causes (over-fishing, erosion and spills) have led to significant decrease in Gulf fish populations during the last decade. Solution: Marine aquaculture of key species can be employed to restore fisheries through restocking and to restore economic vitality through technology transfer and stimulation of small businesses resulting in job creation. This effort should be highly collaborative involving institutions in all five Gulf States as well as other national and international institutions, public and private, with significant hatchery technologies. Implementation Team: Gulf of Mexico Hatchery and Fisheries Restoration Consortium. - Gulf Coast Research Laboratory/University of Southern Mississippi (GCRL; lead institution) - University of Texas Marine Science Institute (UTMSI) - Louisiana University Marine Consortium (LUMCON); - Auburn University (AU) - Mote Marine Laboratory (MML) - University of Maryland- Baltimore (UMB) These institutions are leaders in marine aquaculture and stock enhancement research, implementation, and technology transfer for the northern GOM. The consortium is built on established relationships and will employ the highest quality science and economic approaches to implement, and transfer the technology to raise significant numbers of fish for fishery restoration and to stimulate private sector small business development. In addition to the implementation team, the consortium has established scientific, governmental agency and commercial advisory teams. Implementation Plan: The technology for aquaculture and fishery restoration of marine fis h varies among species. This necessitates the collaborative involvement of these 6 leading institutions that have conducted research on over 10 of the most economically and ecologically important Gulf fish species. Among the species are those for which the technology to implement stocking, technology transfer, and business stimulation already exists. The species targeted for immediate implementation of stocking and technology transfer include Red Drum, Spotted Sea Trout, Red Snapper, White Shrimp, Bull Minnows, Croaker, Florida Pompano, Cobia, Greater Amberjack and Southern Flounder. Projected Results: The work of the consortium will result in advanced technologies for use by Gulf States fishery agencies and private industry. Similar efforts in the Mediterranean Sea led to a $1 Billion industry in 10 years. The 2007 NOAA aquaculture plan projects 75,000 jobs created for every million tons of seafood produced by aquaculture. It is estimated that aquaculture of Gulf fish species would double the seafood output of the Gulf of Mexico ($700 Million in 2008). Additionally the recreational fishing industry (>$12 Billion in 2008) would realize expanded employment and business opportunities as natural populations are restocked with hatchery produced fingerlings.		$60,000,000
	Addressing Marine Debris to Expedite Recovery along the Gulf Coast	The significant and long-term negative impacts along the Gulf Coast resulting from the Deepwater Horizon oil spill will require a suite of restoration projects. In addition to physical marsh restoration and other activities to restore resources, the entire Gulf region will significantly benefit from a targeted, sustained outreach and education campaign to improve the health of impacted resources. This type of restoration project, conducted as part of NRDA in the past, will reduce future injury to protected species - both marine mammals and sea turtles - and their habitats through the reduction of existing marine debris as well as the prevention of future introduction of hazards. By preventing preventable future injuries, this project will enhance the capacity for species and habitat recovery and the time of impact to recovery will be shortened. Enhancing nearshore and shoreline habitats through reducing impacts of marine debris will aid in the long-term, sustainable recovery of the Gulf Coast at an accelerated rate. Specifically, this project will effectively coordinate and execute a two-year, intense outreach and education campaign that will result in lasting changes after the project is complete. Hosted at the NOAA Disaster Response Center in Mobile, AL, and coordinated as a NOAA partnership project with the NOAA Marine Debris Program as lead coordinator, this project will engage all five states, maintain and improve partnerships with state and local organizations, and strengthen public engagement across the Gulf. This project t is specifically targeted to involve and educate Gulf Coast communities how marine mammals, sea turtles, and habitat will all directly benefit from debris prevention and removal. The project will also look to identify targeted areas for debris removal that will have the most impact to improve the ecological health of the Gulf. Key contacts associated with this project already have strong professional working relationships across th e region. As has been successfully demonstrated in previous projects in the Gulf of Mexico, Sea Grant extension agents have a unique capacity to strengthen community involvement - including select communities where English is not the first language - and broaden awareness through effective beach clean-ups, fish rodeos, etc. This project will incorporate powerful Public Service Announcements, print materials, and technology to effectively raise the awareness across the Gulf States that a sustained outreach campaign focused on debris prevention and removal will benefit livelihoods in the entire region in both the short and long-term.		$10,000,000
	LL&E South LaFourche Marsh Restoration and Levee Protection Porject	North Carolina based Restoration Systems (RS) proposed a very promising project to the South Lafourche Levee District that can feasibly be implemented for Natural Resource Damage Assessment compliance in 180 days from Notice to Proceed. The project described is the LL&E South Lafourche Marsh Restoration and Levee Protection Project. RS describes is a ¿Full-Delivery,¿ bonded restoration and mitigation banking company. The company has 22,000 acres of restored, preserved and enhanced wetlands and ecosystems at 40 locations in seven states. In Plaquemines Parish, RS is permitting the Jesuit Bend Wetland Mitigation and Coastal Protection Mitigation Bank. That project is identified in the Master List of restoration projects under consideration for Trustee finding pursuant to the BP oil spill Early Restoration Agreement. RS has the the right to acquire permanent conservation servitudes on the project areas upon completion of the five year-monitoring phase, or before if required. The company has agreed to allow Restoration Systems to make this proposal contingent on contract completion which is expected within the next month. Habitat improvement activities will be bonded and monitored for success over a five-year period or longer if required by the Trustees. RS has completed nearly 35 successful projects bonded for success in a similar manner. The company will utilize only A+ Rated surety companies which require substantial capital and assurance of implementation according to contract. The project is on the wet-side of the east and west banks of the Parish levees protecting the South Lafourche community and surrounding area. This area, easily visible on attached satellite photographs, has converted from marsh and cypress swamp over the last century to shallow, open water areas. Phase One has approximately 650 acres of marsh restoration. Phase Two has approximately 636 acres of marsh restoration and Phase Three has approximately 560 acres of marsh restoration. In order to convert the site to its historic condition, RS will permit the dredge, pump, and placement of material into the restoration area from sources previously permitted for dredging located near each phase. The placement and planting with natural and appropriate vegetation will provide a natural barrier to storm and wave attenuation at the toe of the Parish levee, which is now open water. Perhaps more importantly for the Trustees, the restoration will also re-establish a number of important and increasingly threatened sporting opportunities and historic ecological communities for local citizens and visitors; including Essential Fish Habitat and nursery for recreational and non-game fish, shrimp, shellfish and other aquatic species. The project is immediately adjacent to CWPPRA¿s PPL21 Bayou L¿Ours Terracing project and will compliment the work that location. Figure 1 shows the planned Bayou L¿Ours project location, the area of which is also shown as RS Exhibit ¿B¿. Also included are other photos of representative projects in the area with the same landowner. The implementation of this project has the support of the South Lafourche Levee District and also enthusiastic local citizen support. It is literally in the backyard of thousands of Lafourche residents whose recreational opportunities are increasingly limited by degradation of this significant habitat before and as a result of the Deepwater Horizon spill. Please let Restoration Systems know what additional information regarding this project that I can provide to the Trustees Council or other appropriate parties.	Lafourche	
	Deep Seafloor Habitat Restoration	Oil products from MC252 have covered a vast area of the deep seafloor, which may have sterilized the benthic habitat. Normal sedimentation rate in this area is appx. 1 cm/yr. Assuming burrowing organisms occupy the vertical space of -60 cm into the sediments, full habitat recovery might require 60 years of sediment deposition to isolate the oiled layer from the biota. A habitat restoration project of 25 km2 is proposed to provide vertical attachment surfaces above the oiled seafloor for occupation by endemic biota. The recommended substrate consists of a 4 m length of black iron pipe 3-inch diameter with 3- 1/2-inch holes spaced 70 cm apart starting at the top of the pipe. The bottom of the pipe is flared and embedded 10-inches into a conical-shaped, concrete drive-point 6-inch diameter X 24-inch length. At a density of 1 pipe/1,000 m2, 25,000 pipes are fabricated, loaded onto a barge and dropped into the Gulf using GPS coordinates for the project location grid. The force of gravity drives the descending pipe into the seafloor (>1,000 m BSL), allowing appx 3 m of pipe to extend above the oiled layer. Monitoring of the deep seafloor habitat grid (plus 60,000 acres adjacent) is performed for 10 years by a scientific team using ROVs (e.g., detached motorized submersibles or gliders) deployed from a research vessel. Telemetry data from the ROV is analyzed for species colonization of the pipe surface and the benthos, and pipe integrity (useful life estimated at 50 yrs). cost/pipe= $25 $625,000 delivery dockside $3 $75,000 Vessel transport DWH $5 $125,000 Total cost/pipe $33 $825,000 Scientific Team 1y $300,000 Deep Submersible ROV $500,000 Ship Time 60 days/yr $300,000 1 yr monitoring cost $1,100,000 1st yr total $1,925,000 9 yr monitoring cost $9,900,000 1 0 yr Total Project Cost $11,825,000 Cost/km2= $473,000 Cost/m2= $0.47		$11,825,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Restore historic Gulf Sturgeon spawning grounds	Remove the sills on Bogue Chitto River at the Pearl River Lock and dam canal and on Pearl River at Pools Bluff. If there is too much political pressure to not remove them, install fish ladders capable and practicle for adult Gulf Sturgeon to move upstream of the sills to return to historic spawning grounds. There were over 28 individuals killed as a result of theTemple Inland release. Temple Inland or any purchaser of the mill including International Paper should fund the entire project.	St. Tammany,Washington	$3,000,000
	Enhancements to marine private recreational fishing surveys	Make enhancements to the marine private recreational fishing survey to improve timeliness and spatial resolution of catch and fishing effort data for better management. Link to Injury: Private recreational anglers lost access to a considerable portion of federal and state waters in the northern Gulf that were closed to fishing during the BP oil disaster. Therefore, the angling public must be compensated for lost access to fishing as a service. Benefit and Rationale: Improving the private recreational survey in the Gulf of Mexico will help keep fishery resources healthy and available to anglers. Specifically, improving the timeliness and spatial resolution of catch and effort data can help fishery managers keep total catch within prescribed fishing limits and prevent recreational anglers from exceeding their quotas and incurring penalties. These improvements would benefit the public by lowering the likelihood of overfishing and accountability measures, which, if triggered, could result in shorter fishing seasons in the future.		
	Proposed Emergency Seagrass Restoration	Per descriptive information in documents entitled "A Concise Environmental Assessment (EA) for Emergency Restoration of Seagrass Impacts from the Deepwater Horizon Oil Spill Response", the following ideas can address and deal with the "Overview of OPA - Emergency Restoration Requirements" (para. 2.3.1 - Items # (3) and (5). I am suggesting that Aquatic Weed Harvester equipment be considered to methodically remove aquatic weeds & vegetation (i.e. - seagrass) that has been impacted by the oil spill and continues to contain oil residues. This process is not to "dig out" the weeds, but to harvest those weeds that continue to maintain oil residues...esentially, HARVESTING those designated weeds without impacting their root systems, thus allowing them to continue to thrive and grow, but without the oil residues on the newly growing vegetation. Aquatic weed harvesting is a known technology and can be accomplished at a reasonable cost. Item 3.2.1 - Description of Proposed Action. The Aquatic Weed Harvesters are basically shallow draft (under 12 inches), twin-pontoon (catamaran type) boats are propelled by twin hydraulically driven/reversible/variable speed paddle wheels. The weeds to be harvested are cut by reciprocating sickle knives (they can cut up to 12 ft wide and to variable depths of 6 ft.), and the weeds then land on and come up open mesh wide conveyors, then load into the vessels storage areas, where they can be further accumulated via storage bed conveyors. Once fully loaded, the Harvester can back up to shore areas, where they can be matched up & aligned w/ conveyorized Shore Conveyors that move the harvested weeds to dump trucks, etc. for off site removal. The entire operation will "avoid causing the same kind of damage to teh seagrassses that response boats caused" Item 3.2.2 Site Identification and Characterization This Item indicates "depth contours of less than one meter depth", certainly wit hin the operating capability of the Weed Harvesters. The operator's elevated position enable a clear sight of the areas to be harvested, thus virtually eliminating the likelihood of injury to the seagrass beds...i.e. this is a very methodical operation. Considering that areas to be harvested are tidal, the Harvesters pontoons can be outfitted w/ hydraulically powered cleats to enable the vessel to operate during periods of very shallow tide.		$500,000
	Aerating the Dead Zone	Begin near the mouth of the Mississippi River and install compressors to pump air into a network of pipelines to oxygenate the water from every oil platform in the area. Keep expanding outward into the Dead Zone and only run the operation during the rainy season. Adding oxygen, like all the delta catfish farmers do, will counter the effects of the depleted oxygen. The aerated surface turbulence will also help to rapidly evaporate hydrocarbons from any future oil spills. Eliminating the Dead Zone would be a much larger benefit to the USA than many of the other research and shoreline restoration plans submitted so far. The oil industry have thousands of miles of pipelines for their 4,000 oil platforms. If each platform had a few air compressors and an air hose pipeline with diffusor heads in a network spreading out two square miles you would have 8,000 square miles of quality water during the months of June, July and August. The Dead Zone estimate for this year is only 7,000 square miles. Compressors could be powered by something renewable or by the gas burn-off on the towers. Figure out how to do one and then it is a simple replicating process. The infrastructure would last for many years and the Dead Zone would rapidly disappear as nature rejuvenates itself into a highly productive, job creating, sustainable region. This may be a larger infrastructure project than you are ready to tackle but I am sure the US Army Corps of Engineers would be up to the task and complete it very fast. They can figure out how much it would cost. I believe the offshore oil industry might contribute also to prove they are good stewards of the environment. Maybe next year we can start harvesting from the former dead zone.		
	Blowout Preventer Backup Safety System (2nd project-Oil Containment Barrier Boom I & II)	Copies of Utility patents pending available.		$1,000,000
	The Gulf Restoration Fund	The Gulf Restoration Fund supports organizations and individuals working on the restoration of the coastal and marine ecosystems of the Gulf of Mexico. The Gulf of Mexico is the ninth largest body of water in the world and home to over 15,000 different species of plants and animals. While the damages and impact of the BP Deepwater Horizon explosion and subsequent spill are still being assessed, this fund focuses on the other 80% of the Gulf that has been destroyed by decades of coastal development projects, agricultural runoff, overfishing and pollution.		
	Algal Community Chracterization and Photosynthetic Performance to Evluate Deepwater Horizon Recovery	Currently DH oil is trapped at the 500m contour, with sloshing bringing oil over the 300m contour. It is likely that the magnitude of this oil movement will increase as it becomes lighter, resulting in greater movement into shallower waters. Critical habitats occur in the 50-150 m contour, particularly micro- and macro-algae. These plants serve as a food resource that is passed trophically to higher consumers, provides refugia for various life stages of fish and shellfishes, and also is critical for sediment stabilization and nutrient recycling. Changes in composition of these primary producers can impact food web function. We propose the analysis of macroalgae and microalgae in terms of standing stock (species) as well as photosynthetic performance. We propose collection of sites along the 40-110 m depth contour at six banks (Flower Gardens west, Sonnier, Rezak, Stetson, Alderdice, Rankin) having long term macroalgal distributional studies (TAMU-CC, USL-Lafayette). We will augment this work examing microalgal distribution (diatoms) for taxonomic diversity from these same locations, and compare to epiphytes of herbarium specimens of macroalgae collected from these same sites. Photophysiology will be assessed by pigment assessment (HPLC), PAM fluorecence theoretical yield, as well as elemental composition of plants (ICP-MS). This data will allow direct correlation of impacts to potential alterations in physiology (short term response) and changes in community composition (long term effects). It is our opinion that the movement of oil onto shallow areas of the continental shelf will occur- the more important issue is to understand the timing and impact of this movement. Coupling taxonomy and physiological experimentation will provide rapid methods of assessment of this eventuality.		$375,000

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	The Development of The Advanced Real Time GNSS and Physical Atmosphere and Ocean Observing System within the Gulf of Mexico	The Development of The Advanced Real Time GNSS and Physical Atmosphere and Ocean Observing System within the Gulf of Mexico Conrad Blucher Institute for Surveying and Science Texas A&M University-Corpus Christi & University Corporation for Atmospheric Research Boulder, CO & Center for Space Research University of Texas at Austin Introduction: The ability to observe our environment in real time significantly increases our capacity to anticipate and respond to changing conditions that may increase the risk of injury and property damage. The installation of a network of instrumentation clusters is proposed for the Gulf of Mexico. The primary instrument of each cluster will be a geodetic quality Global Navigation Satellite System (GNSS) receiver. Observations derived from this network will promote research on ocean-atmosphere interactions; hurricane intensity forecasting; sea level and coastal subsidence monitoring; and storm surge modeling. Each of these topics was given high priority in a recent survey of the oil and gas industry operating in the Gulf . It is anticipated that equipment can be deployed on both fixed and floating platforms, significantly improving the observational capability of the region. The deployment of this instrumentation on offshore platforms would allow these research topics to be addressed and combined in a unified measurement system throughout the Gulf region. Advances in GNSS analysis techniques now enable the continuous positioning of mobile instrumentation to less than a few centimeters. The precision of this measurement can be used for continuous monitoring of sea surface height, tides, and wave motion. The addition of both temperature thermistor strings and underwater acoustic instrumentation provides a link to sea surface temperatures and ocean bathymetry. These same analysis techniques are able to measure the delay of GNSS signals as they pass through the atmosphere. This delay can then be related to the integral of atm ospheric water vapor. This establishes a link between the sea surface temperatures and the latent heat in the atmosphere that contributes to hurricane intensity changes. The recent environmental disaster following the sinking of the Deepwater Horizon offshore drilling rig has highlighted the need for more ocean observing systems to better measure the physical processes occurring in the Gulf of Mexico. Scientific measurements in this harsh offshore environment are difficult to obtain and cannot be undertaken without access to the large number of offshore platforms owned and operated by the offshore industry. This white paper proposes a partnership between the private offshore industry and the scientific community to collect critical physical data to enhance our knowledge of the atmospheric and oceanographic processes that drive the forces that interrupt our ability to manage the vast economic and natural resources of the Gulf of Mexico. Figure 1: Proposed GNSS network in Gulf of Mexico (yellow). Existing GNSS stations used to estimate PW (precipitable water vapor) are shown in black and red. A collaborative research group, consisting of academic and governmental researchers, has expressed interest in the establishment of this Gulf network. The members of the group have diverse expertise and research interests, ensuring that there would be broad application of these data if available. Scientific Applications A report by the American Geophysical Union (AGU) after the 2005 hurricane season summarized some of the fundamental research and observational capability that is relevant to the Gulf . Topics that were addressed in this report include hurricane intensity forecasting, storm surge modeling, and subsidence monitoring. A short synopsis is provided on how each of these topics would benefit from this network. Atmospheric interactions and hurricane intensity forecasting: GNSS observations can be analyzed to provide integrated precipitable water vapor (PW) es timates of the atmosphere. These measurements provide continuous monitoring of atmospheric PW and are insensitive to rain and clouds. PW estimates are now routinely being used at NOAA to improve precipitation forecasts in the continental U.S. Estimates of PW within the Gulf would provide a strong link between ocean temperatures and atmospheric water vapor. An illustration of this is shown in Figure 2 for data collected on the island of St. Maarten in the Caribbean. This figure shows the PW estimates obtained from a GNSS station on the island and the sea surface temperature (SST) around the island. It is clear from this comparison that the two fields are highly correlated. This implies that the local SST in the region has a significant influence on the total column water vapor, not just surface humidity just above the surface. Figure 2: Time series of daily PW values (blue) and sea-surface temperature (red) for the region round St. Maarten. Assimilation studies for two specific hurricanes, Dean in 2007 and Gustav in 2008, have been extensively studied. Both show a positive improvement in the forecast of minimum surface pressure with the three-dimensional variation assimilation of PW into the Weather Research and Forecasting (WRF) model. Assimilation results are shown in Figure 3 (Dean) and Figure 4 (Gustav). The WRF model is running with a 12-km horizontal resolution and is initialized using the GFS analysis fields. Both cases show an improvement of approximately 20 hPa (1 hPa ≡ 100 Pa SI units of pressure) when the PW data are assimilated into the model. A simulation experiment with stations distributed in the Gulf of Mexico has shown further improvement in intensity forecasts, highlighting the need for routine atmospheric observations in the Gulf. Figure 3: The GOES satellite image on the left shows Hurricane Gustav as it entered into the Gulf of Mexico. The color-coded numbers represent the location of continuously operating GNSS stations and the in tegrated water vapor in the atmosphere above each station. The more water vapor, the more latent heat available that the storm can use to strengthen and intensify. Incorporating these data into the Weather Research and Forecast (WRF) model improved the prediction of hurricane strength, as shown by the time series of minimum surface pressure shown on the right. The forecast without GPS observations is shown in blue, with observations in maroon, and the observed minimum surface pressure is shown in red. The addition of GPS instrumentation into the Gulf of Mexico is expected to further improve hurricane intensity forecasts. Figure 4: Same as Figure 3, but for Hurricane Gustav in 2008. Storm Surge Modeling: The data and research will be based on the operation of the coastal observation network managed by the Texas A&M University-Corpus Christi (TAMUCC) Division of Nearshore Research (DNR) [Michaud, 2001]. The core of the network is composed of the 25 Data Collection Platforms of the Texas Coastal Ocean Observation Network (TCOON) and the 7 water level monitoring platforms of the National Ocean Service National Water Level Observation Network in Texas. Other platforms include the Houston/Galveston PORTS stations, the Sabine PORTS stations, and the Port of Corpus Christi Real Time Navigation System (RTNS), three of the largest U.S. ports by tonnage. The overall network presently consists of 30 active stations and is the largest coastal ocean observation network in the Gulf of Mexico (see figure 1). It should be emphasized that all aspects of the operation of this network including instrumentation, measurement procedures, maintenance, and data management follow NOS equipment and instrumentation, data quality control, maintenance and operation procedures, and standards. Principal investigator, Dr. Gary Jeffress, is the director of the TAMUCC unit overseeing all aspects of the network operations. Other project participants manage the operation of the network an d design and implement associated predictive and now-casting models. The network archives and publishes in real-time or near-real time the following time series: water levels, wind speeds, wind directions, barometric pressures, water and air temperatures, dissolved oxygen, salinity, water currents and wave climates depending on the station. Data transfers are completed via Freewave packet radio, GOES satellite communications, and Internet Protocol Modems depending on the station location. The data is accessed through the World Wide Web, at http://lighthouse.tamucc.edu/, and through dedicated phone lines. The operation and management of the network is entirely based on the World Wide Web. The underlying software has been developed at DNR over the past fifteen years [Michaud, 2001] using open source technologies such as Linux and Perl, with the advantage that DNR is not subject to changes in proprietary systems and has the flexibility to replace and evolve software components as new technologies become available. In the past five years data intensive modeling techniques have also been developed to take advantage of the flow of real time data. Models based on Artificial Neural Networks (ANN) and Statistical techniques are presently implemented to provide predictions of water levels [Tissot, 2005] as well as other parameters such as water temperature. Background on ANN Modeling and Hind-casting: The concept of artificial neural networks (ANN) emerged in the sixties as scientists aimed at emulating the functioning of the brain. After the development in the late eighties of efficient training techniques ANNs have become powerful modeling tools especially for non-linear systems. The other main advantages and key characteristics of ANNs for this application are their generic modeling capacity, their robustness to noisy data, and their ability to deal with high dimensional data. The range of ANN applications span a growing number of fields including an increasing n		$16,000,000

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	Restoring critical habitats in the Gulf of Mexico Marine Protected Area Network	In April 2011, the Rookery Bay National Estuarine Research Reserve (RBNERR) hosted a two-day workshop in Naples, Florida, with funding support from NOAA's Marine Protected Area (MPA) Center, that brought representatives from four key agencies managing MPAs in the Gulf together to discuss collaborative efforts. NOAA's NERRs and NMS, and DOI's NPS and NWRs were represented. Outcomes of the workshop included a commitment from the Gulf MPA partners to work together to build a framework for regional response to catastrophic events such as the Deepwater Horizon spill, share information and technology relating to climate science, and to seek regional opportunities to advance common stewardship goals of MPAs such as habitat restoration. A regional approach to restoring critical marine and coastal habitats within the Gulf of Mexico MPA Network has significant benefits: -Gulf MPAs already have long-term monitoring and GIS capabilities that can effectively track changing environmental conditions correlating with restoration success, such as water quality. -Gulf MPAs have on-the-ground programs in place designed to provide protection and increase awarenwess of the need to conserve resources, such as law enforcent, education, outreach and training, visitor use management, and active community-based volunteer programs. -Gulf MPAs have a diverse range of critical marine and coastal habitats within their designated boundaries (e.g corals, seagrasses, oyster reefs, mangroves, saltmarshes) including offshore submerged resources, that link directly to the life cycles and migratory patterns observed in economically important marine species including various species of sportfish, shrimp, and crabs. Envisioned is a three-year regional collaborative restoration project that builds on the strengths of the newly established Gulf of Mexico MPA Network noted above. RBNERR, with support from NOAA, is currently working on developing the initial framework and communications/training supp ort for the Gulf Network. The proposed regional habitat restoration project would have three components: (1) Year I: Gulf MPAs will work collaboratively within the Network to identify high priority habitats suitable for restoration that meet criteria for regional linkages, and develop a regional scope of work for restoring habitats within 8 - 10 MPAs. (2)Year II: Gulf MPAs initiate site restoration projects, engaging community volunteers as appropriate and monitoring progress. (3) Year III: Gulf MPAs complete site restoration projects, continue monitoring efforts, and conduct targeted outreach to raise awareness of value of restored Gulf habitats.		$50,000
	Enhancements to marine charter for-hire fishing surveys	Make enhancements to the charter for-hire telephone fishing effort survey for improving fisheries management. Link to Injury: Members of the public who hire charter boats to fish offshore lost access to a considerable portion of federal and state waters in the northern Gulf of Mexico that were closed to fishing during the BP oil disaster. Charter boats provide access to offshore fishery resources for members of the public who do not own vessels themselves. Benefit and Rationale: A telephone survey is the primary method used by fishery managers to collect charter for-hire fishing effort, which helps track quota usage. Making enhancements to the survey, such as increasing frequency and sample size, would result in more effective monitoring of fishing effort, improved management and possibly longer fishing seasons. Better data from enhanced telephone surveys would help fishery managers be more responsive and adaptive in their management of fishery species exposed to oil. Other: This project could be compensatory in nature if a reduction in fishing that anglers experienced in 2010 due to oil-related fishery closures is offset in the future by extending fishing seasons made possible through better (more accurate and precise) data on fishing effort. For example, an enhanced charter for-hire telephone survey in summer 2010 increased the precision of catch and effort estimates that allowed, in part, the red snapper fishery to reopen in the fall of 2010 after a summer closure.		$5,000,000
	Mechanically Produced Thermocline (Hurricane Barrier)	The Gulf of Mexico is expected to be Oxygen depleted for the next ten years due to the accelerated bacterial activity feeding on the oil in the deep. We propose a system to oxygenate the surface waters and increasing the available food at the bottom of the food chain by promoting phytoplankton growth. The Mechanically Produced Thermocline Based Ocean Temperature Regulatory System is a system to pump cold water from a depth sufficient enough to produce a thermocline on the surface of the ocean. The difference in temperature and salinity between the surface water and the water pumped up from the deep keeps the two from mixing. The temperature and salinity differences between the water from a depth of 2000 to 3000 ft and the water on the surface in most tropical and subtropical seas is sufficient to create a thermocline. The system to create the thermocline consists of a floating pump surrounded by a separation barrier, with a feed tube attached to the bottom of the pump. The pump in the system that we have designed is powered by ocean currents, but the concept is not limited to the use of our pump. The pump we have designed is a floating vessel with turbines set into each of its two sides. The turbines are directly geared to an impeller. The impeller pumps water from the top of the column of water in the feed tube. The feed tube is open at the bottom. The water that is replacing the water that is being pumped is coming up from depths up to 2000-3000 ft. The water that is pumped off of the top of the column of water overflows the pump and is caught by the separation barrier. The feed tube is a flexible membrane that is seamed into the shape of a tube which is open on each end. The feed tube is suspended from the bottom of the pump and hangs down into the deep water. The feed tube is kept open with rings which are attached to the inside of the tube at regular intervals. The tube is kept in a vertical position by lines which are attached to the bottom of the pump, ha ng down the length of the tube, inside the tube, and are attached to a weighted ring, which is attached to the bottom of the feed tube. The separation barrier is a flexible membrane attached to the perimeter of the pump, above the level of the turbines. The separation barrier extends out to an inflated ring, to which it is attached. The separation barrier catches the water that is pumped up. The separation barrier prevents mixing of the pumped up water and the water below it. The barrier allows the water to flow out smoothly over the surface of the water as the pumped up water overflows the inflated ring. The thermocline is beneficial in many ways. The mass of cold water promotes phytoplankton growth, increasing food available for fish. The increased growth of phytoplankton sequesters CO_2 which can then be consumed by zoo-plankton in the form of carbohydrates. The zoo-plankton sequesters the carbohydrates into calcium carbonates and calcium bicarbonates. The calcium carbonates and bicarbonates sink and are sequestered into the depths of the ocean, potentially for thousands of years. A larger scale thermocline can be created by the use of multiple pumps in strategic groupings. These large-scale created thermoclines can be positioned to work as a cold water barrier to hurricanes and tropical storms.		$82,500,000
	Blue Crab Trap Removal	Crab traps are a significant problem in the Gulf of Mexico, having negative impacts on habitat and species. Derelict gear such as blue crab traps can cause a number of problems since throughout the Gulf of Mexico, more than 250,000 traps are thought to be added to the derelict population each year (Guillory 2001). The most significant is that they continue to catch and kill a variety of species, in a process called ghost fishing. Traps can also damage habitat, interact with threatened and protected species, and introduce debris into the food web. They also hinder commercial operations such as shrimp fishing and can result in damage to boats and injuries to people. Derelict gear can persist for decades once it is lost. These traps can be physically removed during winter months due to the shallow water depths at that time of year. This is a "shovel-ready" project that would involve both state partners as well as local fishermen who would be contracted to conduct the removal. Based on estimated annual trap losses, including increased loss rates due to hurricanes and storms, it is estimated that this project could retrieve 500,000 derelict crab pots if fully funded. States have derelict trap programs that are habitually compromised by inconsistent budgets and participation rates. There are no NEPA concerns, with the only legal requirement being coordination with State agencies for short-term closures to facilitate removal activities. Removal will positively impact species by minimizing bycatch, including more than 20 species of fish and 6 species of invertebrates. The number of derelict traps in the Gulf of Mexico is currently unknown. There are, however, some annual estimates of trap disposal and overall trap loss; the latter also includes trap loss due to theft. Estimates of annual trap loss on a percentage basis for each Gulf state range widely: 30%-50% in Florida; 20%-50% in Alabama; 20%-30% in Mississippi; and up to 100% in Louisiana (Guillory 2001). Rolling fishe ry closures, coordinated closely with the most appropriate agency in each state, will allow for the physical collection of derelict or lost blue crab traps. States independently manage their own existing trap removal efforts, and this restoration project will have strong education and outreach. Traps will be removed from the coastal environment, and recycled to avoid waste contribution to landfills. Local fishermen and personnel will be consulted to determine the regions most in need of cleanup.		$10,000,000

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	Marshalling the Mussel for Shoreline Stabilization	Louisiana's coastal land loss is significant and well-documented. Hard structure has been used for decades to deter erosion with limited success and high cost. In particular, hard structures designed to recruit and grow oysters are popular and currently being tested in several locations for improved shoreline resiliency. While oysters are often cited as key species and critical bio-engineers for shallow water coastal ecosystems, they may not be the best choice since (1) building hard-structure for oyster recruitment is costly, (2) there are limited locations with suitable water access and vessel access, and (3) the oyster's primary value to many is from its harvest value, which involves removal of oysters from the system and runs counter to the goals of developing non-harvest oyster reefs for shoreline restoration and protection. An alternative to building hard structure for oyster reef creation would be to use a different native bivalve ecosystem engineer which does not require hard structure, and is not harvested for its economic value. Such an organism is the native ribbed mussel, Geukensia demissa, which is found across the estuarine landscape in areas similar to where the oyster is found. As with all mussel species, ribbed mussels attach by byssal threads or beards and can be found attached as clusters to marsh grass stalks. Enhancing ribbed mussel populations may provide increased marsh shoreline resiliency by enhancing shoreline structure. At the same, as suspension-feeding bivalves, these mussels would provide many of the same ecosystem benefits as oysters, including water filtration and habitat provision. The advantage of mussels is clear in that hard structure is not required for their populations to thrive, significantly decreasing the cost associated with shoreline restoration and protection, and reducing the need to locate materials suitable for providing a reef base (i.e., limestone rock, cement structure, shell cultch). Furthermore, a s ribbed mussels are not a species of economic harvest value, political debates as to the protection from harvest of these shoreline structures would be unnecessary, and issues related to restoration of these bivalves in areas closed to harvest would no longer be a concern as has been recently around the country. Lastly, culture methods are well known and larvae may be reared at the Sea Grant Bivalve Hatchery at the LDWF Marine Research Laboratory on Grand Isle in large numbers (> 50 million /week production capacity during hatchery season). These hatchery-produced pediveligers could then be remote set at selected shorelines. As ribbed mussels are not a species of economic interest, little is known about their ecology and range within coastal Louisiana, or the survival and deployment of hatchery- produced stocks. This project proposes to: (1) identify areas suitable for ribbed mussel growth and shoreline enhancement in coastal Louisiana, (2) from wild-stock, use the hatchery to produce ribbed mussel pediveligers, and (3) conduct preliminary tests at selected marsh locations of deploying hatchery-produced pediveligers as a means to restore oiled shorelines and increase shoreline resiliency in interior marshes. This project would provide a viable and politically feasible alternative to the use of oyster reefs for shoreline protection. Objectives: This project proposes to: (1) Spatially survey existing ribbed mussel populations in the Barataria estuary relative to tidal height, energy (fetch) and vegetation community along a salinity transect to identify areas suitable for ribbed mussel growth and shoreline enhancement in coastal Louisiana; (2) From wild-stock, document the gametogenesis of native Geukensia demissa populations for developing broodstock conditioning protocols and produce 50 million mussel pediveliger larvae/year for two years at the hatchery; and, (3) Use the hatchery-produced pediveligers and remote setting to test t he effectiveness of larval mussel deployment, survival and growth at marsh sites along a salinity gradient as a means to increase shoreline resiliency in interior marshes. Methodology In the Fall of 2011, Geukensia demissa populations will be located and surveyed along salinity transects. Locations will be placed on a survey map, and information on salinity, water temperature, tidal height, vegetation community, shoreline position and orientation and population density and size will be quantified. From these surveys, a minimum of 6 paired control and test sites, 30 m in length, will be selected for remote setting of hatchery-reared larvae. Sites will be selected along the salinity gradient, along shorelines with different orientations. As much as possible, vegetation community will be similar between all sites to be used for testing. Adults will be collected monthly from these sites for histological evaluation of gametogenesis. Adults will also be collected in Winter 2011-12 and Spring 2012 to develop a conditioning protocol to produce ripe gonadal condition at the hatchery for subsequent spawning and larval rearing during the Summers of 2012 and 2013 using standard hatchery techniques. Remote setting at the selected marsh test sites will be conducted during high tide using standard methods. Random quadrat sampling along the marsh edge will be conducted monthly for number and size of mussel populations. Temperature, salinity, sediment soil properties and vegetation community data will also be collected during this time period. Data will be statistically tested comparing mussel number, size and growth between treated and untreated shorelines, and by salinity and shoreline orientation. If necessary, co-variates of vegetation or sediment properties will be included in the model. Rationale Shoreline restoration and protection are critical tools in the fight against coastal erosion, yet most protection methods are very costly due to mat erials handling and deployment. Enhancing ribbed mussel populations may be a low cost alternative to traditional shoreline protection (rocks), and created oyster reefs using bio-engineered materials, since mussel larvae are easily moved from a hatchery using standard remote setting techniques. Increasing mussel populations to create "mussel mats" may prove to be a viable option for increasing shoreline resiliency, while also providing added ecosystem benefits of water filtration and habitat provision. This proposed project addresses restoring the function and productivity of Louisiana's degraded ecosystem by focusing on a strategy to restore damaged and lost wetlands to the functional equivalent of natural ecosystems based on realistic ecological metrics, hydrologic requirements, and design criteria.	Jefferson	$155,592
	Door Point and Pelican Point Living Shoreline Stabilization Project	This project provides for the fabrication and installation of bio-induced oyster reefs to stabilize Door Point and Pelican Point shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through the attenuation of wave energy utilizing vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. Vertical reef units also enhance species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds. ReefBlk vertical reef technology is successfully in use in St Bernard Parish and along other estuarine shorelines in Louisiana, Texas, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area.	St Bernard	$3,500,000
	Cranetown Bay Living Shoreline Stabilization	The project includes installation of approximately ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-150 feet from the shoreline. The orientation will create a lagoon-like area of calmer water favorable for creation of marine nursery habitat. Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize Drum Island shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds, thus increasing an area’s economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. This project will stabilize up to 1100' of highly eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100 from the shoreline. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in a portio n of the protected area to facilitate overall marine nursery activity.	St Bernard	$2,000,000
	Cranetown Bay Living Shoreline Stabilization Project	Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize Cranetown Bay shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. This project will stabilize eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-150' from the shoreline. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in a portion of the protected area to facilitate overall marine nursery activity. The project can be developed and implemented in shovel-ready fashion. CEI's experienece obtaining permits for The Nature Conservancy's Lake Eloi ReefBlk project and establishing landowner protocols combined with easily expandable current ReefBlk operations in Hopedale, La, ensures rapid approval and implementation of the project. The fabrication and staging for this project will occur in St Bernard Parish creating jobs to offset the negative impacts of the Deepwater Horizon Spill to the fisheries ind ustry of the region.	St Bernard	$2,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Drum Bay/Fishing Smack Bay Living Shoreline	Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The project is an important aspect of maintaining the area's salinity regime for oyster production and preserving the storm buffering capacity of the Biloxi Marsh. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. This project will stabilize highly eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100 from the shoreline at strategic locations. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in a portion of the project area to facilitate overall marine nursery activity.	St Bernard	$9,000,000
	Evaluating the effectiveness of restoration projects as waterbird habitat along the Gulf Coast	Many construction and restoration projects have been conducted on the Gulf of Mexico to create and restore areas for use by wading birds and shorebirds. However, many of these projects have not been adequately evaluated to determine the actual success relative to providing appropriate habitat for different bird species. The time that projects are useful as habitats is also not well known. Differences in physical and other characteristics of different projects may lead to differential use by birds and affect their useful life. It would be useful to determine what the effectiveness of different restoration projects are for different bird species so as to better construct or restore for conditions that are the most favorable in creating nesting habitat. For example, are some projects only used for resting and loafing versus nesting? Is the density of particular nesting species different on different projects because of the different characteristics created in different islands? The Gulf Coast Bird Observatory proposal presented here would be to develop and implement a standardized Gulf Coast-wide protocol to evaluate all restoration efforts to date to define the best restoration practices that can then be applied to new restoration efforts relative to establishing bird habitat.	multiple	$2,000,000
	Bird Friendly City Initiative	Establish a grant program that would provide funds or awards to towns along the gulf coast that establish bird friendly initiatives. A non-profit could be tasked with defining what qualifies as bird friendly and establish the program. I believe beach towns along the gulf coast would be willing to establish bird friendly measures if there was some funding involved. Such measures could include fencing dunes areas for least tern nesting sites, establish dog leash laws, establishing clear beach access points to beach that avoids dunes and nesting habitat, leaving the wrack alone, etc.		
	Sodium Percarbonate dead zone oxygen replacement	Dispense Sodium Percarbonate tablets into the area that will become the season's dead zone just as the rainy season washes the nutrients into the area. Each tablet would represent a missing plant on the seabed and supply dissolved oxygen for a month. Similar to salting the highway in winter this inexpensive "oxygen pill" might keep the fisheries and related industries open. Stop dropping these pills when the annual algae bloom finishes it's cycle. Drop drop fiz fiz oh what a cheap relief it is. http://www.runyoutech.com/percarbonate_spec.htm		$10,000,000
	SAV-E: SAV Establishment plan.	SAV (Submersed aquatic vegetation) are #1 for fisheries habitat. While a focus in fisheries resources has been on marshes and marsh edge as valuable habitat, abundance of nekton is even higher in SAV (Rozas and Minello). This resource does not receive planning, restoration, or grant support mainly because it has not been inventoried in the the muddy waters of the northern Gulf coast (Merino et al.). Whereas other states that have inventoried sea grasses, recognize and support their fishery resource through state management plans, the northern Gulf state most affected by the oil spill has not. Louisiana, having the majority of the nations deltas, has the greatest potential for SAV that would aid in water quality and fisheries habitat. These functions are well recognized and supported in the the Chesapeake Bay area. These functions help offset those caused by oil spills, both the DWH and future events. 1.) Survey the resource 2.) Convene a panel of experts to establish a plan, based on the areas and opportunities of need 3.) Provide guidance for community-based restoration on execution 4.) Get the state and restoration in the northern gulf to implement the plan along with other restoration programs, such as the CWPPRA, LCA, and CIAP.		
	Saving the Gulf Coast one bale at a time.	We are a Louisiana Non-Profit 501(c)(3) Corporation (pending) devoted to preservation and reclamation of the Gulf Coast. We have developed and perfected the use of locally grown hay and wheat straw to mitigate, prevent, and ultimately reverse coastal erosion. Our process not only stops erosion, it also restores nesting and colonization sites for the countless species of birds that are native to the Louisiana Gulf Coast, including the Brown Pelican. When fully deployed, our process will clean and restore existing habitats while literally creating new wildlife havens to be enjoyed by future generations. Our process uses round hay bales produced by American farmers and delivered by American truckers. The environmental benefits of using hay instead of toxic chemical dispersants are plainly obvious. Hay is the only truly "green" solution available to preserve, restore and reclaim our Gulf coast. Hay has incredible natural absorption capacity and has proven ability to stop and even reverse coastal soil erosion. We propose to purchase large quantities of hay and wheat straw from regional farmers, paying them a favorable price-per-ton for delivery to established distribution points along the Gulf Coast. 1000 pound plus round hay bales will serve as barriers along the coastal areas and wetlands around the gulf region. Our market research shows a fully adequate supply of hay is readily available. In particular, there is 200,000 to 400,000 acres of winter wheat planted in Louisiana alone each year. We would like to create a market for the farmers by baling the straw that is leftover after the wheat is harvested. This leftover straw is usually just burned in the field. LSU and the Wildlife and Fisheries Department have expressed interest in coming in behind our barriers to plant marsh grasses and mangrove trees. They feel that they will get an additional 2-3 years of protection from our plan. In time the wicking of the hay will collect and create sediments and for m a natural barrier. This plan is just a larger scale of what is used in construction sites along the highway systems when small square bales are used to control erosion. Our ultimate goal is to provide a lucrative market for hay grown and produced by American Farmers and to use that hay for cleaning, preserving and reclaiming our treasured Gulf Coast. In turn, any profits earned will be donated to other coastal and wildlife preservation organizations and agriculture related organizations.	LA	$250,000
	vessels of opportunity	Hire local fishing boats to collect long-term data on the environmental impacts of the spill. Find out if the tar on the bottom is being digested by natural organisms and identify which ones. Figure out the rate that the tar and oil is biodegrading. Do definitive research on whether dispersants are safe for the environment or do they do more damage than the original spill? Do experiments on different types of bio-remediation on the beaches and in the wetlands to see whether they are effective. If they work use them on a large scale.		
	Ocean floor Recovery Project	Build large vacuum cleaners to pipe up the oil that is laying just below the ocean floor. The oil can be pumped and filtered into tankers. It's right there. Scoop it up it up. It's money in the bank. I don't want a dime. I would just like to give money made to 5 charity's and the people who clean up the gulf.		
	Low-cost, 10km-range Oil Spill Sensor and Spread-predictive Sensor Deployment	This project will establish a low-cost, remote oil spread monitoring system with the following features: - Oil Sensor Design: There is an urgent need for inexpensive, weather-robust oil spill sensors that can wirelessly report oil data. Existing oil spill sensing technologies have the following drawbacks: (1) Inaccuracy: Infrared thermal sensing and ultrasonic wave / pulse cannot accurately detect oil existence and oil thickness levels because the temperature, weather, and water current can greatly change their readings. (2) High-cost: SAR imaging and laser fluorosensors use heavy, expensive, large-size devices, and thus are not suitable to large area monitoring. (3) Power inefficiency: Although some wireless sensors can use low-cost light array sensors to detect oil thickness, their chip designs have not emphasized low-power circuit layout. More importantly, it does not have long-distance wireless transmission capability due to its use of common, low-sensitivity antenna (to be discussed in next item). In this research, we will design a low-power, low-cost, weather-robust oil spill sensor and its corresponding sensor operation control software (such as sampling rate adjustment and sleep/wake control). - 10-km oil sensing data transmission: The harsh sea conditions necessitate 10-km-transmittable oil sensors. Due to the large area monitoring of sea surface, the existing wireless sensors cannot be used here due to their short RF communication range (typically less than 100 m). The windy sea weather and harsh water current could make any two neighboring sensors separate from each other for a distance of >100 meters (even though the proposed sensors are adhesive to the oil). In this project, we will use our unique ferrite miniature antenna technology to achieve a 10-km RF communication distance and 1-km neighbor communication range. If an oil sensor cannot use its neighbors to relay the sensing data, it can directly send signals to a wireless base station. Those flo atable base stations are pre-deployed sporadically on the sea surface. A sensor can communicate with its neighbors or 10-km away base stations. - Oil spread boundary estimation: It is important to build an accurate oil spread trend estimation model based on the analysis of the data from oil spill sensors. Such a boundary estimation model can be used to guide the deployment of new sensors (ty		$350,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Coastal Land and Marsh Protection	This is a general recommendation, not tied to a specific project: Instead of habitat restoration, focus instead on purchasing lands in fee title or in easement to protect these fragile and ecologically important areas that are threatened by future development while they still exist. As you know, land development usually causes condiitons that are irreversible. By protecting these areas in perpetuity, we would permanently protect these areas and the ecological services they provide for a multitude of coastal terrestrial and aquatic species. By doing so, we not only protect habitat for many species, but also prevent future damage to human structures as a result of climate change (severe weather events such as hurricanes, sea level rise, etc.). It is my personal opinion that protecting as much currently undeveloped land as is possible from future land development, especially in coastal areas that typical exhibit a more rapid growth rate than in other areas, is the singlemost important thing we should be doing with available funding. To me it is a more valuable use of dollars than habitat restoration, which is very costly and may or may not be successful.		
	Habitat Mapping for Improved Stock Assessments and Developing an Integrated Habitat Restoration Approach for Marine Habitats	Habitat mapping will facilitate comparisons of species distributions and abundances across like habitats, allowing scientists to better stratify fishery-independent sampling by habitat type and improve the quality of information used to assess the health of fish populations. Habitat mapping is critical following the BP Deepwater Horizon disaster because fishery scientists will need the maximum amount of spatial precision to detect changes in abundance of fish exposed to or injured by oil or chemical dispersants. This information would also reduce the scientific uncertainty used to define catch limits and would improve managers' ability to aid the recovery of injured fish species through suitable measures. A better understanding of habitat types and distributions generated through habitat mapping would also help the Deepwater Horizon BP Trustee Council identify habitats for restoration that would provide services of the same type and quality and of comparable value to those lost. Results of habitat mapping could be used in an Integrated Habitat Restoration Approach, which is a comprehensive plan based on restoration of key habitats that, together, will benefit the range of different resources injured by the release of Deepwater Horizon BP oil or related response effort. This project will also lay the foundation for broader research and management applications of habitat mapping, and has the potential to be integrated with additional information systems. For example, coordination with oceanographic data (Gulf Coastal and Ocean Observing System) or the development a fishing vessel data collection system habitat maps could be incorporated into real-time management and research tools. The cost of this project is scalable, depending on the size of area and degree of resolution selected for mapping. Prioritizing habitat mapping activities can be done in consultation with the Southeast Fisheries Science Center whose stock assessment scientists would be among the primary users of this information. Time to implementation is six months to one year.		
	N&P pollution control, and restoring clean water	We have a "SLOW", dissolving-in-water 1 kilo log, which can be dropped by helicopter or by hand into any water area. The Log contains a patented formula of Fertilizer, which allows the DIATOMS to bloom and become the dominant algae and clean up the water. 1 log will clean approx 1 million gallons.		
	Increased Catch and Effort Reporting for the Gulf of Mexico's Marine Recreational Fishery Based on 1-month waves	Recreational anglers lost access to a considerable portion of federal and state waters in the northern Gulf that were closed to fishing during the BP oil disaster. Fishery closures amount to lost ecosystem services or human uses of resources that the Natural Resource Trustees are required to estimate and offset through appropriate compensatory restoration projects. One strategy for compensating the angling public for lost fishing access is making investments in fishery management tools that help keep fishery resources healthy and available to anglers. One such tool is the Marine Recreational Fisheries Statistics Survey (MRFSS), which collects data on recreational fisheries data used to estimate total catch. The public can be compensated for lost access to fishing grounds during the 2010 Deepwater Horizon BP oil spill by establishing a one month survey reporting waves versus the current two month reporting waves of MRFSS. A more timely reporting system would benefit the public by lowering the likelihood of overfishing and accountability measures (i.e., penalties), which if triggered, could result in a shorter fishing season. Increased data collection and reporting periods will lead to more precise and timely catch estimates. MRFSS in the Gulf of Mexico does not produce timely fishery catch and effort estimates required by managers. The MRFSS catch and effort estimates are based on a two month data collection waves with estimates produced up to 45 days after the end of a wave. For reporting to be on one month waves, with sufficient precision for management, an increase in sampling will need to occur. MRIP proposes to meet this goal; however a concurrent increased funding allotment has not been secured. Survey costs, on average, will need to double from the current level of funding. The National Research Council's 2006 Review of Recreational Fisheries Survey Methods, recommended for one month reporting of catch and effort estimates be implemented. The Marine Recrea tional Information Program (MRIP) is redesigning the MRFSS survey to accomplish this task. As an example, the red snapper season, as currently defined, closes well before the estimates are produced. The current estimation methodology has inadvertently allowed the recreational fishery to overharvest red snapper in twelve of the last twenty years, and has triggered fishery accountability measures; such as shorter red snapper seasons for recreational anglers. A timely and accurate recreational data reporting system will allow fishery managers to be proactive in the Gulf of Mexico, improving their ability to predict fishing trends and prevent overfishing.		$10,000,000
	Brush Island Bird Rookery Conservation Project	Brush Island is recognized by the Louisiana Department of Wildlife and Fisheries as a rookery for a variety of bird species. Pelicans, sea gulls, terns, American Oyster Catchers and Piping Plover among other species inhabit the island. The island provides a combination of oyster ridges and marsh/shell island platform conducive for nesting of these species. However, the island shoreline has deteriorated significantly as a result of high energy storm and normal wave erosion. The project will create a shoreline protection barrier beginning on the northwestern corner of the island and extending approximately one-quarter mile down the southeastern shoreline utilizing vertical oyster reefs (ReefBlk) and oyster cultch. ReefBlk units will be deployed and #57 concrete aggregate will be spread in strategic locations to a thickness of 4-8 inches extending from the shoreline at mean high tide into the water for a distance of 50-150'. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercut of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the project area. Brush Island received heavy oiling along the project shoreline and was cleaned under STRs issued by Unified Command and it s successors. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$750,000
	Deepwater Pass Living Shoreline Stabilization	Project Description: 30° 0'38.74"N, 89°12'51.92"W 30° 0'43.79"N, 89°12'59.14"W Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize the shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. The project will prevent breaching of the narrow marsh/shell shoreline and resultant exposure of the interior bay to high energy open water conditions. Such a breach would accelerate island deterioration. This project will stabilize up to approximately 800' of shoreline by restoring intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk combined with cultch spreading. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bio-engineered structure dampens and dissipates wave energy to protect the estuarine marsh from erosion. These proven living shoreline and erosion control methods are currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The proposed use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. The project includes installation of approximately 800' of ReefBlk units aligned parallel to the shore and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100' from the shoreline. The project area is recognized as a historic rookery by the Louisiana Department of Wildlife and Fisheries. SCAT reported light oiling in the region. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$700,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Grand Pass Living Shoreline Stabilization Project	30° 6'10.14"N, 89°14'56.01"W 30° 6'17.84"N, 89°14'57.60"W Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize shorelines and help restore and sustain valuable and sensitive estuarine ecosystems in the Biloxi Marsh. This project will stabilize the shoreline by restoring intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bioengineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion. These proven living shoreline and erosion control methods are currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The proposed use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. The project will stabilize approximately 800' of shoreline by restoring intertidal oyster reef habitat using ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-75 from the shoreline. The ReefBlk units and cultch function as substrate for oyster spat attachment and allow growth of an intertidal reef. The project area has experienced shoreline erosion and the narrow marsh ridge propos ed for stabilization currently threatens to breach into an interior bay. SCAT reported light to very light oil impact in the project reach, but including the project reach, there was contiguous shoreline oiling for over six miles in this area. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$650,000
	Comfort Island Living Shoreline Stabiliation Project	29 49' 25.45, 89 15' 4.19 to 29 49' 26.74, 89 14' 47.65 Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize Comfort Island shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. This project will stabilize up to 1450' of highly eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100 from the shoreline. This project can be shovel ready shortly after the funding award. Staging can be achieved by expanding current ReefBlk operations at Hopedale,La, and previous ReefBlk permitting and attendant land owner protocols in the area will facilitate and speed permit acquisition. The shoreline in the project area was cleaned under STR 3-17 for pooled oil, patties and oiled debri s in the middle and upper tidal zones. Comfort Island is identified as a historic rookery by LDWF. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	
	Lake Fortuna/Machais Living Shoreline Stabilization Project	Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize shoreline situated in Lakes Fortuna and Marchais and to help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercut of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds and leases, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the project area. This project will stabilize up to 2.81 miles of eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100 from the shoreline. Cultch would used strategically to forestall erosion at the most critical points within the project footprint, estimated at 15-40% of the total project shoreline. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in particular locations. This project will work in concert with a currently funded ReefBlk project in Lake Marchais to prevent the eros ional loss of marsh islands that obstruct the northward encroachment of open water conditions into fragile interior shoreline estuary of the historic Bayou Terre aux Boeufs distributary marsh. This project is shovel ready and will integrate with The Nature Conservancy's and NOAA's Lake Fortuna/Machais project now underway. Permit approval has already been received for the proposed project for installation of ReefBlk under the permit obtained for The Nature Conservancy/NOAA project. Staging and logistics can be implemented immediately upon grant receipt by expanding the current ReefBlk operation at Hopedale, Louisiana. This project is one of a number of critical living shoreline projects for St Bernard Parish described more generally under NOAA's NRDA project list as "Use induced high vertical profile oyster reefs to stabilize critical areas of shoreline erosion and to enhance habitat conditions with living shoreline geometries".	St Bernard,St. Bernard	$4,800,000
	Live Oak Bay Living Shoreline Stabilization and Oyster Enhancement Project	The project will stabilize a marsh/shell ridge that forms a protective reach for the northern Drum Bay shoreline and is under severe erosional threat of segmentation. It is an important geologic framework element for the conservation of the Conkey Cove remnant ridge complex. The complex is among the most important of the barrier island chain in St Bernard Parish. Contiguous light to moderate oiling stretched for over seven miles along the complex's shoreline. The project will stabilize approximately 1900' of shoreline by creating intertidal oyster reef habitat using ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-150' from the shoreline. The ReefBlk units and cultch function as substrate for oyster spat attachment and allow growth of an intertidal reef. This project can be considered 75% shovel ready. Staging and logistics for the project can be implemented immediately upon grant and permit approval by expanding the current ReefBlk operation at Hopedale, Louisiana now servicing The Nature Conservancy project for Lake Eloi. A standard template for permitting and landowner protocols has been established as an outcome of the Lake Eloi project and thus permitting can be expected to proceed without undue delay. Coastal Environments, Inc and partners will fabricate and install bio-induced oyster reefs to stabilize shorelines and help restore and sustain valuable and sensitive estuarine ecosystems in the Biloxi Marsh. This project will stabilize the shoreline by restoring intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bioengineered structure dampens and dissipates wave energy and prot ects the estuarine marsh from erosion. These proven living shoreline and erosion control methods are currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent oyster grounds and leases, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. Fabrication and staging for the projects will occur in St Bernard Parish creating jobs to offset the negative economic impact suffered by the commercial fisheries industry of the parish. The oyster is the keystone organism for the estuary, and the vertical reefs will contribute spat to nearby oyster leases and increase the robustness of the marine habitat in general. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale, which is also listed under NOAA NRDA projects. The project is a specific element of the shoreline stabilization NRDA request submitted by The Nature Conservancy.	St Bernard	$800,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Keelboat Island Living Shoreline Stabilization Project	ReefBlk living shoreline and erosion control methods are currently inducing the growth of bioengineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The proposed use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. The project includes installation of approximately 750' of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-75 from the shoreline. The orientation will create a lagoon-like area of calmer water favorable for creation of marine nursery habitat. The project area has experienced shoreline erosion and was impacted significantly by oil from the BP spill. The area was included in an STR for cleanup of Keelboat Island that generated over 140,000 lbs. of oil and oiled debris. Keelboat is recognized as a historic rookery by the Louisiana Department of Wildlife and Fisheries. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St. Bernard	$700,000
	Gulf of Mexico Community-based Restoration Partnership	The Gulf of Mexico Community-based Restoration Partnership (GCRP) is a regional multi-year partnership that was established in 2001 between the NOAA Community-based Restoration Program (CRP), the EPA Gulf of Mexico Program Gulf Ecological Management Sites (GEMS) Program, and the Gulf of Mexico Foundation. The purpose of the partnership is to strengthen conservation efforts by supporting on-the-ground projects to restore coastal marine habitats, benefit living marine resources, and foster local stewardship of the sites. This successful collaboration will help to expand restoration of habitats that are critical to the sustainability ofnatural resources in the Gulf of Mexico, and to continue to expand public education and outreach efforts to broaden participation in restoration activities, further developing a conservation ethic at the community level. To date, the GCRP has funded 76 community-based restoration projects. These projects occurred in a number of habitat types. In total more than $3 million has been funded by the Gulf of Mexico Foundation towards these restoration projects, of which an additional $5.5 million has been leveraged in matching contributions from project partners. This match includes nearly 50,000 contributed volunteer hours. In total, more than 15,000 acres of coastal habitat have been restored as part of these partnership projects. A multi-agency steering committee works effectively to guide the partnership in soliciting and developing projects, reviewing and selecting projects for funding, ensuring required permits and assurances are acquired, and monitoring project progress and compliance. There is a broad diversity of groups involved in the partnership projects, including school children and other community volunteers, universities, nonprofit groups, business and industry, and coastal planning organizations, such as NEPs and NERRs. Collaboration between the partners, many of which have their own public outreach programs to link w ith the GCRP, will result in long-term stewardship of the restored resources and help generate a community conservation ethic. The GMF will lead further development of the GCRP in a manner that best addresses a regional approach to restore coastal marine habitats and benefit the natural resources of the Gulf of Mexico. Our goal is to take action towards reversing the downward trend in habitat loss and increase the attention on the growing need to preserve and protect America's Gulf Coast.	Multiple	$1,500,000
	Joyce Wildlife Management Area	Historical modification: The building of a railway and a parallel highway bisected wetlands eliminating the east to west flow of water through the Joyce Wildlife Management area and surrounding wetlands. Additionally, the dredging of a slough canal adjacent to the management area blocked input of freshwater from the upland watershed with the placement of the spoil on the south side. Explicit goals and objectives: Benefits and or goals include: reconnection of freshwater flow to the Joyce WMA and surrounding wetlands; remove nutrients from wastewater treatment plants upstream; and improve current delivery system to include water control structures for flood/drawdown plusing. Type of restriction impeding or preventing historical hydrological flows: Road Railroad Design strategy to address issue: Water control structures (i.e., gates and weirs) Top three ecological benefits: Improved habitat longevity and sustainability Adaptation or accommodation of sea level rise Improved ground water and surface water quality		$250,000
	Lake Eloi and Lake Athanasio Living Shoreline Stabilization Project	Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize Lake Eloi shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercut of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth which serves to create long-term armoring through sub-tidal and shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. The project will stabilize approximately 3.43 miles of eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100 from the shoreline. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in a portion of the protected area to facilitate overall marine nursery activity. Cultch would be used strategically to forestall erosion at the most critical points within the project footprint, estimated at 10-20% of the total project shoreline. Project implementation is recommended as a critical measure to preve nt the northern encroachment of open water conditions deep into the heart of the Biloxi Marsh should the project shorelines continue to erode at present rates. This project is shovel ready and will integrate with The Nature Conservancy's and NOAA's Lake Eloi ReefBlk project now underway. Permits for the proposed project has already been approved for the installation of ReefBlk. Staging and logistics can be implemented immediately upon grant receipt by expanding the current ReefBlk operation at Hopedale, Louisiana. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale, which is also listed under NOAA NRDA projects.	St Bernard	$5,250,000
	Louisiana Gulf Coast Oyster Shell Recycling	The objective of this project is to develop a cost effective program on the Louisiana Gulf Coast to recycle oyster shell from consumers (restaurants, shucking houses, oyster fisherman, individuals who purchase oysters by the sack, etc.) that can then be used to restore and enhance shellfish habitat destroyed or damaged as a result of the Deepwater BP Oil Spill. An effective program will require educating consumers on the importance of recycling and encouraging their participation in a program that recycles oyster shell for use in replenishing natural oyster beds and stabilizing shorelines. Suitable substrate is critical to developing a viable reef, and the substrate material (cultch) preferred by oyster larvae is oyster shell. Since the early 1900¿s, agencies of the various Gulf states have been depositing cultch material, mainly native shell, on public oyster grounds to build and enhance reefs. Currently a significant amount of the shell produced by consumers is deposited in landfills. Because much more shell is removed from public oyster grounds than is returned for habitat development and enhancement, the Gulf of Mexico is experiencing a shell deficit. This project is designed to reduce that deficit by recycling shell that would otherwise end up in landfills. The additional recycled shell will then be available for current or future oyster reef and shoreline restoration projects. Developing a cost-effective program to recycle shell for use in reef-building will be crucial to coastal restoration projects in the Gulf of Mexico. Similar programs have already produced positive results in Chesapeake Bay as well as in coastal areas of North Carolina, South Carolina, New Hampshire, and Texas. The project proposed here will use information from those state programs to develop an effective program for recovering oyster shell produced by Louisiana Gulf Coast consumers.	Saint Tammany, Orleans, Saint Bernard, Palquemines, Jefferson, Saint Charles, Lafourche, Terrebonne, Assumption, Saint James, Saint Martin, Iberia, Saint Mary, Lafayette, Vermilion, Acadia, Jefferson Davis, Cameron, Calcasieu, Tangipahoa, Livingston, Baton Rouge, Saint John the Baptist, Ascension, Iberville, Pointe Coupee, Saint Landry, Evangeline, Allen, Beauregard	$8,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Keelboat Island Living Shoreliine Stabilization Project	Project Description: Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize eroding shoreline and help restore and sustain valuable and sensitive estuarine ecosystems on Keelboat Island in the Biloxi Marsh estuary. This project will stabilize up to 750' of shoreline by creating intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk and cultch application. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bioengineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion. The applied cultch provides additional shoreline armoring and habitat for spat attachment and oyster reef development. Keelboat Island received extensive oiling and was under STR cleanup until completion in April of 2011. Over 142,000 lbs. of oil and oiled debris was removed from the island. Keelboat is recognized as a historic rookery by the Louisiana Department of Wildlife and Fisheries. ReefBlk living shoreline and erosion control methods are currently inducing the growth of bioengineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. CEI proposes to design, fabricate and install a patented artificial oyster reef system, ReefBlk along the eastern edge of Keelboat Island to forestall further erosion within a well art iculated erosional zone and to create a lagoon-like condition to encourage marine nursery activity. The overall goals of the project include reef construction, shoreline stabilization and armoring, marsh regrowth and faunal utilization. The project includes installation of approximately 750' of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100' from the shoreline. The project can be developed and implemented in shovel-ready fashion. CEI's experienece obtaining permits for The Nature Conservancy's Lake Eloi ReefBlk project and establishing landowner protocols combined with easily expandable current ReefBlk operations in Hopedale, La, ensures rapid approval and implementation of the project. The fabrication and staging for this project will occur in St Bernard Parish creating jobs to offset the negative impacts of the Deepwater Horizon Spill to the fisheries industry of the region. This project is one of a number of critical living shoreline projects for St Bernard Parish described more generally under NOAA's NRDA project list as "Use induced high vertical profile oyster reefs to stabilize critical areas of shoreline erosion, and to enhance habitat conditions with living shoreline geometries". It will also be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$300,000
	Clovelly Project	The total property available for the Clovelly Project (approximately 9,500 acres total) consists of approximately 5,000 acres of land for marsh restoration (brackish and saltwater) and an additional approximately 4,500 acres of land suitable for preservation. Within the 4,500 acres suitable for restoration there is a 500 acre parcel for which the detailed feasibility and design work has already been completed. The 500 acre parcel is "shovel-ready" and could potentially be developed sooner than the rest of the bank. It should also be noted that this restoration project would also include some element of hurricane protection and would be large enough for a bird sanctuary or other wildlife refuge. Finally, because of the project's scale, the cost on a per-acre basis would be significantly lower than it might be for smaller projects. In addition we would like to highlight: (1) Flexibility of project size: If an initial project of less than 9,500 acres is desired, the balance can be subject to a reasonable option for further development at a later date. Also, if the possibility of a project larger than 9,500 acres is desired, adjoining landowners have expressed an interest in cooperating by providing expansion options. (2) Sustainability of recreated marsh: The proposed project will have superior strength and longevity provided by two factors not readily available elsewhere: (a) mineral soil to elevate the sunken marsh and (b) salt-tolerant fresh water plants to provide additional organic material needed to overcome sea-level rise. (3) Enhanced sea life food web: The brackish marsh created by this project will provide the recognized superior detritus forming the base of the sea life food web for plankton, minnows, shrimp, crabs and oysters. The value of this detritus can be enhanced by optimizing the use of selected brackish marsh plants in the restoration process. The USGS, which has already successfully generated the salt tolerant fresh water plants currently in u se, has expressed interest in pursuing a detritus optimizing study for this and future brackish marsh projects.	Lafourche	$230,000,000
	Drum Bay Island Living Shoreline Stabilization Project	N29.920408, -89.260139 N29.918289, -89.261200 Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize Drum Island shoreline and help restore and sustain valuable and sensitive estuarine ecosystems. Shoreline stabilization will be accomplished through both the attenuation of wave energy utilizing ReefBlk vertical profile oyster reefs and shoreline armoring utilizing aggregate cultch. The vertical profile ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that expands linearly and vertically. This reef dampens and dissipates wave action thereby retarding erosion and undercutting of the marsh platform. ReefBlk also enhances species habitat diversity and provides oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. ReefBlk technology is successfully in use along estuarine shorelines in Texas, Louisiana, Alabama and Florida. The use of cultch substrate provides immediate shoreline armoring and similarly induces oyster growth that serves to create long-term armoring through shoreline oyster shell accretion and deposition within the project area. This form of natural armoring occurs throughout the Biloxi Marsh area. This project will stabilize up to 1100' of highly eroding shoreline by strategic alignment of ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100' from the shoreline. Given appropriate bottom conditions, alignment of the ReefBlk units will create a lagoon-like habitat in a portion of the protected area to facilitate overall marine nursery activity. This project can be considered almost fully shovel ready. Staging and logistics for the project can be implemented immediately upon grant approval by expanding the current ReefBlk operation at Hopedale, Louisiana now servicing The Nature Conservancy project for Lake Eloi. Permitting for the Drum Bay Island project also is facilitated by having obtained permits previously for this type of activity within the subject area and by having established landowner protocols. The shoreline in the project area was cleaned under STR 4-003 for mats in the middle and upper tidal zones and patties in the lower tidal zone. Drum Island is identified as a historic pelican and wading bird rookery. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$750,000
	Codfish Point Living Shoreline Stabilization Project	Project Description: Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize shorelines and help restore and sustain valuable and sensitive estuarine ecosystems in the Bayou La Loutre headland in St. Bernard Parish. This project will stabilize up to 5700' of shoreline by restoring intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bioengineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion. Oyster cultch will be spread within the project area to further retard erosion and enhance oyster and related estuarine habitat. ReefBlk is a proven living shoreline and erosion control method currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent pubic oyster grounds, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The proposed use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. The cultch application will consist of #57 concrete aggregate or limestone spread 4-8" thick to a distance between 50-100' from the shoreline within the project area. The project will provide effective long-term erosion reduction for a remnant headland that provides crucial natural services through mai ntenance of the hydrologic regime necessary to commercial and sports fisheries of the southern Biloxi Marsh and by serving as a significant natural storm surge barrier for fishing communities in eastern St. Bernard and Plaquemines Parishes. St. Bernard Parish sees this project as an important element of a larger effort to fortify shorelines throughout the Biloxi Marsh as part of the parish's long-term coastal management plan. An STR was issued for the project area by GCIMT with cleanup completed in the spring of 2011. The area was cleaned of thick tar at various shoreline locations. The project area is recognized by the Louisiana Department of Wildlife and Fisheries and U.S. Fish and Wildlife for its value to migratory and wintering shorebirds including the federally listed Piping Plover. This project falls within the overall scope of education and research contemplated for the Oyster Research Center at Hopedale which is also listed under NOAA NRDA projects.	St Bernard	$1,800,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Early NRDA Restoration Louisiana Delta	Early NRDA Recommendations June 25, 2011 Coalition to Restore Coastal Louisiana Environmental Defense Fund Lake Pontchartrain Basin Foundation National Audubon Society National Wildlife Federation The Nature Conservancy Planning for restoration in Louisiana was well-advanced prior to the BP Deepwater Horizon Oil Spill. We support efforts to use early NRDA funding to advance projects that are ready to be implemented and which are based upon tested techniques that have had proven success in achieving restoration goals for the Mississippi River delta, and for addressing damages caused by the spill. Delta building sediment diversions-- We nevertheless recognize that the projects listed below fail to address the underlying, systemic impediment to long term coastal ecosystem restoration in the impact area, which is the separation of the Mississippi River from its delta. It is unfortunate that no pulsed sediment diversion and sub-delta building projects are either ready to be implemented, or able to be scaled and phased to the restoration funds available. We encourage the Trustees to consider combining NRDA funding streams in out years to construct one or more of the pulsed sediment diversion projects now advancing through the planning and compliance process, such as White's Ditch or Myrtle Grove. Consideration should also be given to funding diversions that would sustain deteriorating interior freshwater ecosystems, such as the Violet Canal Diversion and the Convent/Blind River Diversion. NRDA Design Changes--While the projects suggested below are in many cases long-standing proposals taken from existing program lists, the special circumstances of NRDA restoration suggest that the phases of projects proposed and other features of the projects should be chosen to offset damage to specific natural resources damaged by the spill. These would include colonial nesting birds; migratory shorebirds; marsh nesting birds and other marsh organisms (blue crabs, brown and white shr imp, etc.); beach nesting birds, sea turtles and beach dependent crabs, mollusks and other organisms; oysters and oyster reef dependent fauna; as well as Threatened and Endangered Species including Least Terns and Piping Plovers. Examples of measures that might enhance the NRDA specific goals of these restoration projects include: Use of artificial oyster reef in place of or along with rock for shoreline protection; Rebuilding colonial bird (terns, gulls, pelicans) nesting barrier islands in the Timbalier, Dernieres, and Breton island chains; Armoring with reef block and adding sediment (where appropriate) to colonial nesting islands (pelicans, spoonbills, herons, egrets, oystercatchers) on disappearing islets on the baysides of the barrier chains, as at Bay Ronquille (e.g. Cat/Mangrove Island) and in Chandeleur and Breton Sounds; Enhancing barrier spits and overwash fans, and designing barrier island and barrier headland restoration projects to incorporate topographic and habitat diversity to benefit migratory shorebirds, nesting Wilson's Plovers and Least Terns, and wintering Piping Plovers. Offshore Marine Restoration--The projects proposed herein are coastal restoration projects. We recognize that much of the natural resource damage caused by the BP spill affected populations of organisms in the marine environment for which there are no ready counterparts for the kinds of physical projects herein proposed. However, we encourage the Trustees to examine actions like enhanced monitoring, artificial reefs, increased enforcement, temporary closures of fisheries (with compensation for affected interests), buy-outs for unsustainable fisheries, and either temporary or permanent marine sanctuaries as measures that might help restore affected resources. Project Substitution - The projects suggested below are often smaller appropriately scaled components of larger landscape level authorizations with broader ecosystem objective - barrier island and headland restoration a s at Terrebonne and Barataria; land bridge projects as at Bayou Dupont; or parts of larger ecosystem restoration projects as at Biloxi Marsh. Trustee agencies should evaluate which segments of these larger projects can be efficiently coupled with other projects for maximum benefit for both NRDA and long-term restoration. For instance, where possible projects should be coupled with CWPPRA or CIAP projects underway to avoid mobilization and de-mobilization costs, or to utilize existing infrastructure such as sediment pipelines. Where savings in time and cost can be achieved by substituting project segments or phases that achieve comparable ecosystem and NRDA benefits to those suggested below, we support such substitutions. Project Selection--The following list of potential projects for utilization of early NRDA funding by the State of Louisiana and the Trustees are based upon our assessment of: OPA early screening criteria (see Appendix A); State selection criteria for early restoration (see Appendix A); Strategic restoration objectives as reflected in the shared vision and campaign goals of our organizations, as well as in Louisiana's Comprehensive Master Plan for a Sustainable Coast, the LCA, and other planning documents. (see Appendix B) Projects: A) Pontchartrain-Breton MRGO Ecosystem Restoration The Mississippi River Gulf Outlet Ecosystem Restoration Plan, still in development, is a multi-component plan designed to ameliorate and reverse some of the damage done as a consequence of the dredging of and failure to maintain channel dimensions of the MRGO. Biloxi Marsh Shoreline Protection Engineered Oyster Reef (Living Shoreline) and Rock Revetment The proposal is to armor up to 30 miles of the eroding Biloxi Marsh interface with Chandeleur Sound and Lake Borgne. Shoreline sections should be chosen based upon rate of retreat, likelihood of breakthrough into interior bays, and habitat suitability. Wherever possible, living reef structures should be used in place of or in combination with rock. Orleans Land Bridge Alligator Bend Marsh Restoration and Shoreline Protection This project will restore approximately 300 acres of marsh on the Orleans Land Bridge by use of marsh creation. It will provide shoreline protection for approximately nine miles of the northwest shoreline of Lake Borgne. The proposed protection will consist of a foreshore rock dike and possible terracing and vegetative plantings in specific areas. B) Barataria LCA Barataria Basin Barrier Shoreline The goals of this project include: restoring dune and marsh habitat as well as stabilizing remaining un-vegetated portions. The project consists of beach, dune and back barrier marsh habitat creation to restore the physical form and function of the Barrier Island and shoreline and provide critical habitat, and long-term sustainability of these features of the estuary. CWPPRA BA-76 Cheniere Ronquille Barrier Island Restoration The project consists of constructing 11,000 linear feet of dune/beach and 259 acres of marsh platform contiguous with the northern side of the Gulf of Mexico shoreline on Cheniere Ronquille in Plaquemines Parish. Specific NRDA enhancements to this project could include armoring and adding material to colonial birds nesting islands in Bay Ronquille and Bay Long using living reef where appropriate. CWPPRA BA-48 Bayou Dupont Marsh and Ridge Creation Project The project consists of creating/nourishing 300 acres of marsh and associated edge habitat through pipeline sediment delivery from the Mississippi River, and creating 11,000 linear feet of ridge along a portion of the southwestern shoreline of Bayou Dupont in Jefferson Parish. It complements the future Myrtle Grove Sediment Diversion Project now being studied. CWPPRA BA-68 Grand Liard Marsh and Ridge Restoration The project consists of creating/nourishing 468 acres of marsh and associated edge habitat for aquatic species through pipeline sediment delivery, and restoring 14,500 linear ft of the Grand Liard ridge to reduce wave and tidal setup and provide fallout habitat for neotropical migrant birds adjacent to Grand Liard Bayou in Plaquemines Parish, Louisiana. C) Terrebonne LCA Terrebonne Basin Barrier Shoreline The goal of the project is to decrease the continuing degradation and deterioration of the Isles Dernieres (Raccoon Island, Whiskey Island, Trinity Island, East Island, and Wine Island) and Timbalier Islands (Timbalier Island and East Timbalier Island), and to maintain the integrity of the shoreline between Point au Fer and Lake Pelto. Raccoon Island Restoration and Protection Raccoon Island is the largest colonial nesting bird colony in Louisiana. This project proposes to extend the life of the barrier island and create additional habitat, including dune and back barrier marsh. TNC TE-67 Maintain Land Bridge between Caillou Lake and Gulf of Mexico In an effort to protect the land bridge between Caillou Lake and the Gulf of Mexico, approximately 21 miles of artificial oyster reef will be constructed and placed along shorelines most in danger of being lost. This project will be executed in three separate phases, and will employ proven engineered reef technology as the means of attenuating wave energy and as a substrate upon which oysters will attach and grow. (See Appendix C) D) Department of Interior Breton National Wildlife Refuge Chandeleur Islands Restoration Sediment pipeline delivery to continue restoration of the main island to build upon work already completed at the north end. Specific NRDA-related add-ons to this project mightinclude adding pumped material to shoals at Curlew, Gosier and/or East Breton to speed up re-emergence of critical colonial bird nesting islands. Delta National Wildlife Refuge Pass a Loutre Dredging, Beneficial Use, and Crevasse Opening The project would re-open Pass a Loutre to flow by dredging the channel, beneficially placing the sediments in Delta Refuge and Pass a Loutre WMA, and by opening crev		
	Acquisition of at-risk landscape and developing independent science-based priority measures for America's Delta.	I'm a credentialed coastal ecologist, with ten years as a faculty member at LSU and 18 years as a coastal policy advisor to five Louisiana governors. My recommendation for allocating Louisiana's portion of the early installment of the CWA funding was described in some detail in an essay published here: http://lacoastpost.com/blog/?p=32499. What follows here is a concise summary. The Louisiana coastal restoration program has long suffered from many problems, not least the fact that elected officials suffer from appalling ignorance of and disregard for coastal science. For example, they deny anthropogenic climate change and accelerated sea level rise from global warming. They also lack the political courage to overrule local opposition to large river diversion projects (the only realistic long term solution to land loss) and they support environmentally damaging, expensive and unsustainable continuous massive earthen levees (such as Morganza-to-the-Gulf) as a primary means of protection against gulf storms. Given this reality I predict with great confidence that allowing Louisiana funds to be subdivided into separate specific projects will become so politicized as to make every project meaningless and a waste of money. Therefore I recommend that Louisiana's $100 million be allocated for two very specific exclusive purposes: (1) acquiring property rights for at-risk landscape; and (2) developing independent science-based priority measures. $75 to 80 million should be used exclusively to purchase surface rights and/or easements to coastal property characterized by: (a) low population density; (b) subject to high subsidence rates and imminent inundation; and/or (c) particularly effective for storm energy absorption, such as privately owned coastal forests that could otherwise be logged. $15-20 million should be used to commission an independent team of geophysical scientists, oceanographers, hydrologists, ecologists and social scientists to develop, within one yea r, a set of priority measures that could realistically sustain specific portions of America's Delta (all of SE Louisiana) into the future.	St. Mary, St. Martin, Lafayette, Terrebonne, Lafourche, Iberville, EBR, Ascension, St. Tammany, St. Charles, Jefferson, Livingston, St. Tammany, Tangipahoa, E. Feliciana,. W. Baton Rouge, Orleans, St. Bernard, Plaquemines	$100,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Big Branch Marsh National Wildlife Refuge	Acquisition of 1,500 +/- acres, in multiple parcels, of coastal emergent habitat intermixed with open water/ marsh habitats. These parcels are inholdings within the existing federal ownership at Big Branch National Wildlife Refuge, which sits adjacent to Lake Pontchartain and Lake Borgne, in southeast Louisiana. The protection of this acreage would also provide an opportunity for important coastal restoration of this coastal wetland system.	St. Tammany	
	Jesuit Bend Coastal Wetland Site and Bank	Restoration Systems has proposed the Jesuit Bend Coastal Protection and Wetland Mitigation Bank in Plaquemines Parish, Louisiana, to the Corps of Engineers and other agencies as mitigation bank to compensate ofr the rebuilding of the New Orleans levees post-katrina. The project can easily be retasked as NRDA restoration project for the BP oil spill. The proposed Jesuit Bend Mitigation Bank (JBMB) encompasses approximately 338 363 acres of open water, wooded berm, emergent marsh, and cypress swamp. Nearly all of the JBMB site has mitigation potential in the form of re-establishment, rehabilitation, and preservation of freshwater marsh and cypress-tupelo gum swamp, including a fishery habitat and bayou. The entire site will be preserved and protected by a conservation servitude. Finally, there is the potential for the bank to increase in size to ±1000 acres if once adjacent land is can be acquired from current owners. An additionalOne 25 acre parcel is the process of being acquired. Site Location JBMB occurs in Plaquemines Parish (Figure 1). The site lies approximately one-half mile west of the Mississippi River at Jesuit Bend; site photographs as provided as Appendix 1a. Site coordinates are 29.74197° N latitude and -90.03363° W longitude in Township 15 South, Range 24 East, Sections 14,15,16, and 17. The site occurs in the East Central Louisiana Coastal Water Basin in the United States Geological Survey eight-digit cataloguing unit 08090301 and Louisiana Department of Environmental Quality's (DEQ) Barataria basin (Figure 2). The approximately 338-acre site is bounded on the east by the Plaquemines Parish Flood Protection Levee (also known as the Plaquemines 2 non-federal levee-PL2, IPET 2009); south by another inundated site; west by pipeline canals and their associated low berms; and on the north by over 20 23 inundated parcels of land. JBMB may be accessed from the Plaquemines Levee by way of the Ollie Pump Station site that is located at the west en d of Ollie Road in unincorporated Jesuit Bend, LA (Figure 3). The Plaquemines Levee is bounded on its east by the Parish Canal and to its east by a Jesuit Bend neighborhood of single-family residences. The land immediately north and south of the site is of the same character as the JBMB site: shallow open-water ponds. The Ollie Canal lies immediately south of the south-adjoining parcel. The lands to the west are the large expanses of freshwater and transitional marsh of the Barataria landbridge, which are separated from JBMB by a pipeline canal. ROJECT GOALS AND OBJECTIVES The goals of JBMB are to restore and preserve the natural community functions of approximately 277 and 51 acres, respectively, of freshwater and cypress-tupelo gum swamp at JBMB that have been degraded due to anthropogenic activities, natural land subsidence, sediment deprivation from the Mississippi River, wave fetch, and the wind, flood and saltwater damages associated with a series of recent hurricanes. The site will be restored by importing river sediments to the site to return it to natural wetland grade and replanting (Figure 4). The post-mitigation wetl ands will be freshwater marshes and cypress-tupelo gum swamps. There will be a transitional forested zone at the eastern edge of the cypress-tupelo gum swamp where it meets the PL-2. JBMB is uniquely strategically located and capable of restoring a variety of biotic and physical functions to the watershed. Therefore, the objectives of JBMB are multiple. - Wetland - Long-term loss of wetland functions at this site will be restored be reversing the causes of the site's degradation. - Physical - New sediment will be brought into the system. This will provide greater flood protection and flood storage, as well as extend the Barataria land bridge. - Biotic - Marsh and swamp habitat functions will be restored and enhanced; sensitive fishery functions (red drum, white and brown shrimp, as well as gulf menhaden, Atlantic croaker and b.	Plaquemines	$32,000,000
	8029 acres mitigation , marsh creation, coastal restoration	Cameron parish http://www.blacklakelandco.com fresh and brackish water impoundments coastal restoration mitigation credit potential marsh and open water prior owner BP - AMMACO permitted for 5000 acres terraces under marsh mangment plan approved by state and core permitted for marsh creation	Cameron	
	Sustaining Louisiana's Seafood industry and preserving ecosystem services through Oyster Culture Budget: $15 million over 5 years	Louisiana Sea Grant and the Louisiana Department of Wildlife and Fisheries recently reestablished the State's oyster larvae and seed production facility to replenish the natural oyster populations damaged by storms and the BP spill and to launch off-bottom oyster farming in Louisiana. We would like to expand this effort to include a large number of coastal residents, interested in pursuing oyster farming both as environmentally and economically sustainable jobs as well as contributing significant numbers of oysters to restoration projects throughout the coastal waters of Louisiana. Our goal is to establish several land based oyster seed production facilities (nurseries) and several water based Enterprise Zones. Participating coastal residents will be provided training and start-up grants to produce oysters for the coastal restoration and for the food market. Participants will be paid to produce juvenile oysters (seed) for introduction onto public oyster grounds, private oyster leases and in areas closed to shellfish harvest, but where the oyster reef ecosystem services are needed. Within 5 years, 500 million juvenile oysters will be added to public and private oyster beds in the region. The intent of this project is to assist State resource agencies in restoring the oyster populations that were lost due to the BP oil spill mitigation efforts and related freshwater events. The enhancement of natural oyster reef structure and oyster abundance will provide for critical ecosystem services through improved water quality, increased biodiversity and creation of more diverse habitat. In addition to creating jobs for participants at nursery sites, the oyster seed produced at a state supported hatchery will be transitioned to the private sector. Oyster farming will also be encouraged through this program by establishing a State program for off bottom culture of oysters. We will establish several water-based Enterprise Zones in coastal Louisiana for the off bottom farming of oysters; fisherman will be provided start-up grants to produce adult oysters for the food market. The Zones will support independently operated 5-acre oyster farms capable of generating additional income through sales of premium oysters. These resultant large single oysters command prices at the higher end of the current market thereby providing greater income for the oyster producers and also reducing pressure on natural oyster resources. Regionalization We strongly encourage the implementation of this approach throughout the Gulf region. Parallel efforts are currently underway in Alabama where Mississippi/Alabama Sea Grant has partnered with us over the past several years in the refinement oyster hatchery and nursery operations as well as pilot off bottom culture. The proposed work has environmental benefits, is economically viable and culturally compatible.	Jefferson,Plaquemines ,Terrebonne,St. Mary,Cameron	$15,000,000
	Sustaining Alabama's Working Waterfront through Oyster Aquaculture	Auburn University has partnered with Mississippi-Alabama Sea Grant Consortium and Alabama Cooperative Extension to launch off-bottom oyster farming in Alabama. Here we propose to expand this effort to include a large number of coastal residents, pursuing oyster farming both as environmentally and economically sustainable jobs as well as contributing significant numbers of oysters to restoration projects throughout the coastal waters of Alabama. 1. Enhancement of public oyster reefs by seeding with juvenile oysters Provide 50 million juvenile oysters per year (set on varying sizes of cultch) for seeding onto public oyster beds to enhance the public fisheries within Alabama, raised by local oyster farmers and in partnership with Alma Bryant High School's aquaculture program. Within 5 years, 250 million juvenile oysters will be added to public oyster beds in the region. For context, public reefs have a density of 2-5 oysters per square meter or 8,000-20,000 oysters per acre. The intent of this project is to assist state resource agencies in implementing existing oyster management strategies where a percent of the oysters on public reefs are harvested and the remainder provide critical fisheries habitat. Assuming 20% survival to market size, this stock enhancement could yield over 6,000 daily limits of eight sacks (AL limits) per year (with 200 market size oysters per sack), providing much needed income to the region, while also providing environmental services. The enhancement of natural oyster reef structure and oyster abundance will also will provide for critical ecosystem services through improved water quality, increased biodiversity and creation of more diverse habitat. In addition to educating high school students and creating jobs for watermen at nursery sites, the oyster seed produced at a state supported hatchery will be transitioned to the private sector. 2. Development of off-bottom oyster aquaculture in the region Establish 2 100-acre oyster aquacultur e parks in Alabama, where watermen are provided start-up grants to produce adult oysters for the food market and juvenile oysters to supplement oyster reef restoration. The two parks will support 40 independently operated 5-acre oyster farms capable of generating at least $2.5 million per year of combined income within 5 years through sales of premium oysters. These oysters command higher prices than those oysters traditionally produced from the oyster reefs in Alabama thereby providing greater income for the oyster producers and also reducing pressure on natural oyster resources. Initial research suggests that a 5-acre operation would allow an oyster farmer to raise 400,000 oysters per year; potentially yielding a gross annual income (with a conservative 80% survival) of over $80,000. This would be a significant increase in annual income for the typical oyster catcher who might currently earn $20,000/year. Regionalization We strongly encourage the implementation of these approaches throughout the Gulf region. Parallel efforts are currently underway in Louisiana where Louisiana Sea Grant has partnered with Louisiana State University. The proposed work has environmental benefits, is economically viable and culturally compatible.	Mobile, Baldwin, Jefferson	$12,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	USING DREDGED SEDIMENTS TO REMEDIATE OIL-CONTAMINATED COASTAL MARSHES	The BP Horizon oil spill resulted in millions of gallons of oil being discharged into the Gulf of Mexico. Despite the best efforts of many, oil remains in vast areas of Louisiana's wetlands. Removing oil from these fragile wetlands is a difficult - if not impossible - task. One viable alternative is to cover oil-contaminated wetlands and shallow sediments with clean dredged sediment. Sediment can be sprayed across the wetland surface in thin layers with conventional dredging technology or pumped into the upper reaches of the marsh and used to restore any damage associated with ingress. Both are proven approaches for marsh restoration with numerous examples of success. Sequestered in the salt and brackish marshes will reduce, and possibly eliminate, impacts to inland fresh and intermediate marshes that are more difficult, if not impossible, to clean using other technologies. Additionally, wetlands along Louisiana's coast have been subsiding due to the lack of marsh accretion; thus, the addition of sediment has other potential advantages. Previous research has shown that coastal wetlands revegetate quickly (within a single growing season) when covered with dredged sediments of modest thicknesses. There is also well-established science demonstrating the effectiveness of covering contaminated sediments with a clean sediment cap to isolate contamination, preventing transport and ecological exposure. A synthesis of existing information suggests that placing dredged sediments on the wetlands should be an effective remedial approach. The general approach of using dredged sediments to nourish and raise wetlands is also well established. There are many successful examples of using dredged sediment to beneficially augment existing wetlands or establish viable wetlands in areas where the pre-existing bathymetry was too deep. There are, however, unique characteristics of the Louisiana Coast that will require further study. These include viable dredged sediment sources (spa tial and temporal availability, sediment quality, etc), logistics of dredged sediment transfer, innovative sediment retention measures, placement measures to minimize sediment loss, best application rates for oil sequestration, ecological sustainability and marsh longevity, and monitoring programs to evaluate best practices. Capping has also been successful at isolating contaminated sediment at many sites, but this particular application requires some additional study. These include testing different depths of mud layers for their effectiveness of immobilizing the oil and restoring natural benthic communities, the effect of dense vegetation on contaminant isolation effectiveness, enhanced degradation that might result from the plant root mass, and the potential for additives to expedite oil degradation below the cap layer. Project Summary: This project will provide a comprehensive assessment of the use of dredged sediments for restoring oil contaminated marsh. It will evaluate important logistical components including sources and volumes of available sediment, sediment transfer and placement, sediment spraying, and equipment availability. The project will also evaluate and test innovative sediment retention measures. Several modular designs have recently been proposed that also allow for ecological exchange, but these designs have not been tested. Field and laboratory tests will also be conducted on the effectiveness of dredged sediment caps to isolate contamination with thick vegetation, the role of vegetation in long-term biodegradation of the trapped oils, the thickness of sediment layers necessary to isolate contamination while allowing the marsh to quickly recover, and the value of biodegradation enhancement beneath the cap. Project Benefits: This project will provide the basis for using dredged sediment to rapidly restore the ecological function of Gulf Coast marshes. The results of this effort will help guide the development of a comprehensive, effect ive, and timely restoration plan through reliable information on the applicability of this approach and the availability of sediment to implement it. The project will provide a roadmap for navigating the logistics of obtaining sediment, transferring it to the site, placement approaches, and retention alternatives. Most importantly, the project will provide reliable data on the ability of sediment to safely sequester the surface oils from the environment and estimate the design life for that sequestration.	Plaquemines	
	Use induced high vertical profile oyster reefs to stabilize critical areas of shoreline erosion, and to enhance habitat conditions with living shoreline geometries	The St. Bernard Parish Government has in place a cooperative project with The Nature Conservancy, an international non-profit conservation organization, to fabricate, deploy and monitor 2.15 miles of induced high vertical profile oyster reefs in the Oyster Zone of the Eastern St. Bernard Estuarine Ecosystem. The currently funded 2.15-mile portion of the project is part of a larger action for which a permit was acquired for construction of 4.54 miles of artificial reef along segments of shoreline in Lake Fortuna, Lake Machais, Lake Athanasio, Lake Eloi and Eloi Bay. The project was selected for American Recovery and Reinvestment Act funding by NOAA as part of the Gulf of Mexico marine habitat stimulus program in 2009. Emplacement of the artificial reef in St. Bernard Parish was delayed by the BP Macondo event, but was re-started in May, 2011 and is being mobilized from Hopedale. The NOAA-TNC project is intended to be the beginning of a far reaching reef building program for the Eastern St. Bernard Estuarine Ecosystem. The project employs a reef building technique utilizing ReefBlkTM that has been proven in projects from Texas to Florida. Individual reef units consist of a welded frame of steel rods that form a triangular column. The nits are 5 feet along each leg of the triangle and are typically 2 feet high, but may be higher depending on site conditions. The frames hold 9 aquacultue type mesh containers (e.g. bags). When filled the 9 bags hold 300 pounds of shell. The welded frame weight 70 pounds for a total individual ReefBlkTM unit weight of 370 pounds. The units are typically placed in a saw-tooth pattern pattern parallel to an eroding shore or bank. The units immediately reduce wave energy and turbidity. Oyster larvae become attached to the shells in the ReefBlkTM. where they become spat that grow rapidly . Under average favorable conditions the oysters grow rapidly and within 12 to 18 months the oysters in one unit produce approximately one t on of new shell. Sediment usually collects behind the new reef. ReefBlkTM units have a solid frame, which when interlocked form a stable structure with a broad footprint. They are light in weight when deployed, but gain weight and stability from rapid oyster growth. The units have a large reef face to mass ratio, with approximately 50 square feet of reef exposure. This feature has the dual advantage of not requiring large volumes of shell, and providing maximum habitat for marine organisms. Because the cultch shell is loosely packed, water and food flows through the reef unit panels accelerating oyster growth and providing favorable habitat for innumerable species of reef attracted organisms. The ReefBlkTM structure provides shelter for larger fish. The individual units are like Lego pieces in that they can be configured for different erosion control and estuarine sculpturing applications. Most importantly the ReefBlkTM units provide a favorable framework onto which living oysters can grow and produce large volumes of shell. Some shells remain on and around the unit and the shells become cemented together to produce a true high vertical profile living reef. Other living oysters and shells are ejected by growth or beak off from the units and are carried toward shore by waves and tides resulting in development of cluster growths of living oysters or an accumulation of finer shell particles that accumulate along the inner shoreline as beaches and oyster banks. One of the most effective geometries for the induced reefs is the "barrier and lagoon." The centerline of the reef is parallel to the shore and 75 to 100 feet from it. Small tidal gaps, 25 to 30 feet wide are left in the reef at intervals of about 110 feet. As trapped sediment and shell accumulates behind the reef tombolos join the reef segments with the shore leaving oval lagoons about acre in extent, where submerged aquatic grass beds can be planted. Shell beaches develop along the shore behin d the lagoons. This design creates a wide range of habitat diversity for oysters, larval shrimp and finfish, crabs, shore birds and wading birds, small mammals, and mature finfish and shellfish. The oysters in the induced reefs are not for harvest, however oyster farmers like the reefs because by reducing erosion they reduce turbidity, which may smother growing oysters in the bottom beds. They also produce billions of free swimming larvae, many of which settle on neighboring oyster beds in leased oyster plots that are harvested. Recreational fishermen love the reefs, as they attract finfish. Construction of artificial oyster reefs using ReefBlkTM units has advanced beyond the demonstration phase to the production phase. Nine projects have been completed successfully in Texas, Louisiana, Alabama and Florida. The first phase of the NOAA-TNC project in Louisiana involved installation of 1200 ReefBlkTM units (6000 feet) on the bay side of Grand Isle.	St Bernard	$4,000,000
	Restore bird islands (rookeries) with combination of cultch spreading and induced high vertical profile oyster reefs.	A number of St. Bernard Parish's water bird nesting areas were oiled. Bird island can be restored using cultch spread and induced high vertical profile oyster reefs as described above. The Audubon Society has expressed an interest in undertaking restoration of bird islands in the area and being an active participant in the Hopedale Oyster Reef Restoration Center. It is proposed that this restoration be supported by BP funding with active participation of the Audubon Society.	St. Bernard	$2,000,000
	Develop an oyster hatchery and off-bottom growout technology	Because of the low spat counts in the eastern St. Bernard estuarine area since the BP oil event a supply of disease resistant, fast growing live larvae is needed as an important component of oyster reef and fishing grounds restoration. Dr. John Supan of the L.S.U. Sea Grant program has developed and is operating an oyster hatchery at the Louisiana Department of Wildlife and Fisheries Facility located at Grand Isle, Louisiana. Part of Dr. Supan's program is to foster advanced technology, off-bottom grow out techniques and to help introduce these techniques to the oyster fishers. Dr. Supan has made a commitment to participate in the Hopedale Oyster Reef and Fishing Grounds restoration program. Funds are requested to move this essential component of restoration of the oyster grounds and industry.	St. Bernard Parish	$1,000,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Develop plan and design for Violet safe harbor	The Violet Canal is an important water gateway from the east bank of the Mississippi River to Lake Borgne via Bayou Dupre. It has been proposed by the U.S. Army Corps of Engineers as a route for a diversion channel to deliver water from the Mississippi into the MRGO channel and Lake Borgne. Near its northern Bayou Dupre end it crosses through floodgates in the flood protection levees and thence crosses the MRGO channel before entering Lake Borgne. Historically it has been a harbor for fishing boats. During Hurricane Katrina a large part of the St. Bernard fishing fleet took refuge in the canal and survived the storm. This is currently the only "safe harbor" in the eastern end of the parish. Until recently there was a shrimp cannery along the canal, but it was closed after Hurricane Katrina. The function of this important canal and the land adjacent to it is in serious need for re-evaluation. Because of the importance of this canal to the fishing industry of St. Bernard it is recommended that funds be provided to conduct a comprehensive economic and land use evaluation and to develop a plan.	St. Bernard Parish	$400,000
	Lake Ponchartrain Shoreline Protection	This is a Shoreline Protection Project that will consist of segmented breakwaters constructed of large stone. These breakwaters will be constructed 200' to 500' off shore with 50' wide openings (Fish Dips). Erosion is currently claiming from 8' to 14' of shoreline annually. The purpose of this project is to arrest this erosion. The projected cost of this project has more than doubled due to the finding of many subsurface stumps and logs that must be removed from the site - also the occurrences of Hurricanes Katrina, Gustav and the BP Oil Spill have escalated material costs far beyond our original estimates.	Tangipahoa	$14,400,000
	Integrated Approach to Wetland Damage Assessment, Vegetation Monitoring, and Restoration Tracking in the Gulf of Mexico	Problem Statement: Tidal wetlands bordering the Gulf of Mexico, including Federal wetlands in National Wildlife Refuge (NWR) areas, are at risk of being impacted by the oil that continues to wash ashore. A comprehensive and accurate determination of the impact over vast remote areas is not feasible with traditional survey methods. In order to identify and implement the most cost-effective solutions necessary for remediation/restoration; a unified, systematic approach using airborne remote sensing coupled with land-based restoration technologies can be implemented to 1) efficiently identify the extent of impacted wetlands, 2) effectively guide the remediation/restoration process from planning to completion, and 3) provide a calibrated measurement of the effectiveness of the remediation/restoration efforts over the long-term. Proposed Solution: SpecTIR proposes to provide comprehensive monitoring and restoration services along the Gulf coast using a proven combination of commercially available aerial remote sensing applications and innovative assessment and monitoring techniques that will promote program efficiency and cost-effectiveness. The team will use a scalable, phased approach that will identify impacted wetlands and allow for the prioritization, planning, and performance of restoration efforts. Additionally, the proposed methodology will provide a consistent and scientific means for accurate and quantitative post-restoration monitoring. The first phase of the proposed approach is to provide a baseline for restoration by collecting airborne hyperspectral imagery or, in the case of many Gulf coast NWR wetlands, assessment of the hyperspectral data already collected prior to impact from oil. Guided by initial analysis of the airborne data, groundtruthing verification and validation of the wetlands will then be performed. SpecTIR will provide the existing 2000 sq km of pre-oil, baseline hyperspectral data collected from Gulf coast NWR areas prior to th e oil entering the wetlands. The use of hyperspectral imagery for the discovery of hydrocarbons in the wetlands has been proven in the NASA funded VNIR study of an oil spill in Swanson Creek MD in 2000. The current instruments now include the SWIR portion of the spectra which brings an even higher degree of accuracy to the identification of the vegetative stress and community structure. Data and analysis will be collected into a GIS platform and be deseminated online to effectively guide restoration planning and implementation. Post restoration remote sensing monitoring will be performed to track changes in restoration success relative to the baseline data as well as coincidently identified non-impacted sites. This data will be supported with ground truthing, data verification, and sampling by qualified field teams. Once the levels of impact to the wetland vegetation has been ascertained and prioritized, the information can be used to assist in the formulation of remediation and restoration plans. Going forward, progress can be monitored with the identical methodologies and technologies used in the initial assessment.		$3,000,000
	Gulf Saver Solutions® wetlands restoration initiative	Example: Restoration of 500 acres of oil soiled wetlands working with WLF at Pass Loutre wildlife management area, Venice, LA Many other sites/projects are scoped as well that would benefit from Gulf Saver bags. www.gulfsaversolutions.com Gulf Saver Bags is a package of native marsh grasses with its own supply of natural nutrients and billions of oil eating micro-organisms to protect, feed and support marsh grasses plugged into the Bag, to take root, survive and flourish. Gulf Saver Bags also support an accreting environment by slowing down the water, which allows sediment to drop, and adding nutrient-rich biomass to the soil. Gulf Saver Bags provide for greater stabilization, higher survivability and integration of diverse species back into challenging wetland sites, and in particular in areas where dredging has been done and material for berms and terracing have been deposited. Gulf Saver Bags offer an innovative technology and application designed to increase project success of habitat and wetland restoration. Gulf Saver Bags are assembled and deployed by volunteers coordinated by well established organizations like Common Ground Relief, Inc. A Solution for Habitat and Wetland Restoration Gulf Savers wetlands initiatives and programs also provide opportunities for collaborations with environmental scientists, and agencies, community based volunteer organizations and school groups providing wetlands education and awareness. Regulatory Acceptance and Endorsed by: Louisiana Department Wildlife and Fisheries National Oceanic & Atmospheric Administration U.S Fish and Wildlife Service LSU Dept of Oceanography & Coastal Science US Army Corps of Engineers Restore Americas Estuaries Common Ground Relief Inc. Coaliton to Restore Coastal Louisianna Global Green New Orleans For the Bayou Bayou Rebirth For more information: www.gulfsaversolutions.com	Plaquemines	$1,000,000
	Marine Finfish Hatchery for Stock Enhancement of Imporant Recreational Species Affected by the Oil Spill	Provide funds to construct and operate a Marine Finfish Hatchery for the culture and release of important marine finfish species such as spotted seatrout, red drum, flounder and blue fin tuna. The uncertainty about the effects of the oil spill on the impact of the eggs and lavae of the 2010 spawn in the Gulf neccesiate the need for stock enhancement of these important recreational fish speices.		$50,000,000
	Response and recovery of the periphyton in the near-shore habitats of the Gulf of Mexico	Periphyton play an important ecological role on seagrass leaves: 1) as primary producers in a seagrass system; 2) as sources of food for consumers; 3) as a source of sediments (calcareous algae); 4) as an indicator of environmental indicator of water quality; and 5) as a `UV-B filter for the seagrass leaves. This research will focus on the response of periphyton on seagrass leaves in by looking at physiological characteristics (short-term response) of the algal community and taxonomic shifts or losses in the community (long-term) in areas that have been impacted versus unimpacted areas throughout the Gulf of Mexico. Several stressors on seagrass communities have lead to their worldwide decline, including an increase in nutrients, higher salinity, and increased wave energy. A new threat came from the weathered oil and chemical dispersants from the Deepwater Horizon oil spill thatcould be impacting seagrass in coastal areas. Although entire seagrass beds may have been completely lost or their density may have been reduced, it is also important to understand that periphyton associated with the seagrass is a vital component of the seagrass ecosystem. The periphyton may buffer the seagrass from some of the moderate effects on the seagrass community. The various single-celled organisms that are part of the periphyton may also serve as sentry organisms; their physiological response to stress can signal an early warning of more substantial impacts to the ecosystem or that recovery is underway. Standardized protocols for sampling seagrass leaves will be used (such as certain distance for the growing tip) for sample collection. The number of replicates and the number of locations will be determined in coordination with work being performed by other researchers. A database will be created that identifies the organisms (images of species), physiological status, and community structure indices at key locations. This information will be collected across seasons to understand natural variability, and through time, to determine the impacts to the ecosystem.		$850,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Testing and Assessment of Archaeological Sites Impacted by the Deepwater BP Oil Spill	More than a year after the Deepwater BP Oil Spill, the immediate and long-term impacts on archaeological sites in the coastal zone remain unknown. Archaeological sites are unique and endangered sources of information on several thousands of years of human-environmental interactions along the Gulf Coast. Monitoring and remediation have documented the presence of oil at many sites, but there has been no systematic attempt to assess the effects on archaeological resources or conservation. Restoration of coastal landscapes and ecosystems will further impact archaeological sites, which are intrinsic cultural components of the natural environment. Testing and assessment of previously recorded sites in Terrebonne, Lafourche, Jefferson, Plaquemines, and St. Bernard parishes will address the impacts on archaeological resources in terms of archaeometric techniques such as neutron activation analysis, absorbed residue analysis, and accelerator mass spectrometry, taphonomic and site formation processes, and archaeological conservation. Sites to be assessed will be selected from those impacted by the Deepwater BP Oil Spill and recorded as potentially eligible for listing on the National Register of Historic Places. Field methods will consist of systematic surface collection, mechanized and hand-operated coring and augering, and excavation of 1-by-1-meter test units to record stratigraphic profiles and obtain archaeological samples. The goals of restoration will be served through damage assessment and recommendations of best methodologies for remediation and conservation.	Jefferson,Plaquemines ,St. Bernard,Lafourche,Terrebonne	$180,000
	Marshland Purification Project	By using shallow water boats equiped with sprayers and tanks, apply EPA approved bioremediation agents, BAAD Bugs (generic is Biorem 2000) and Oil Digester if need be into any oil soiled marsh land areas without disrupting the natural habitat in any way. Test for hydrocarbon presence in a week and reapply if necessary. The project may be implemented under our guidance, using employees from the State, Federal or Local government, displaced BP workers or displaced fishermen. The bioremediation agent is the only agent that is from all naturally occuring microbes from the ocean, is completely safe for animals and humans and remediates on impact. Estimated cost is 5000 dollars per acre plus testing, including labor and boat usage.	St Bernard	
	Submersible concrete barge surge breaker project along East Biloxi Marshes Shoreline Barrier Zone, Pilot	One solution to the construction of artificial barrier islands and breakwaters in high wave energy areas is the use of submersible concrete barge technology. The St. Bernard Parish Government, in a resolution of May 18, 2010, proposing construction of the East Biloxi Marshes Shoreline Barrier Zone in the BP oil impacted area supports the use of submersible concrete barge surge breakers as a major component of the barrier. While the merits of this approach are recognized, it is yet to be tested. Because of the urgency for finding a practical, cost effective solution to construction of barriers this pilot project is proposed. A local manufacturer has custom-designed and built submersible concete barges as platforms for oil and gas field production facilities for decades. The barges are built of reinforced concrete on a land-based drydock and floated to the operation site where they are submerged and rest on the bottom of the gulf, coastal bays or lakes. A crushed rock bed is usually placed on the water bottom at the deployment site. It is not uncommon, after decades of service, to re-float a barge, update the production equipment and use the barge at a new location. Some of the barges have been in operation for more than 40 years and the barges have survived surge and waves from the most severe storms. Large barges are 200 x 70 x 14 feet and can be floated in 6 feet of water. A vertical extension can be added above the barge to increase its effective height for blocking surge and waves. For applications in the construction of the East Biloxi Marshes Shoreline Barrier smaller 80 x 24 x 15 feet barges equipped with an additional 3 foot high breakwall and a draft of 5.5 feet may be used. Advantages of the barges are that they can be standardized for efficient manufacture at an onshore facility. They can be moved to deployment areas through inland navigation channels by tug boats. They can usually be placed without dredging an access channel. Th ey do not sink into the substrate. They are supportive of oyster growth and other marine encrusting organisms. If conditions change the barges can be floated and re-deployed. The barges are a cost effective alternative to the use of heavy rocks, massive concrete structures, and dredging of buried sand deposits.	St. Bernard Parish	$4,500,000
	Develop a finfish hatchery and submersible concrete barge fingerling growout tanks.	Proven aquaculture technology exists for hatchery produced and controlled growout of key coastal species of finfish, specifically speckled trout and red fish. The neighboring state of Texas has a program for controlled growout and release of these species. Red fish and hybrid striped bass have been successfully grown in coastal waters of Louisiana and marketed to restaurants in the state as a private enterprise. Submerged concrete barges can be used as finfish growout tanks. Funds are requested to develop these facilities.	St. Bernard Parish	$2,000,000
	Operating costs for Hopedale Oyster Reef and Fishing Grounds Restoration Center	During the BP Oil event it was found to be necessary to establish a temporary center for the Unified Command at Hopedale, Louisiana to coordinate and implement emergency measures. Hopedale is literally at the end of the road and the jumping off area for the vast eastern St. Bernard Estuarine area. At the peak of the response 2500 people were working at the center. It was a small city with hundreds of boats and vehicles. At the end of the crisis, the center was de-mobilized. As we move into the evaluation and restoration phase of the oil event as well as into other environmental restoration projects in the area such as the Mississippi River Gulf Outlet (MRGO) ecosystem restoration program, it has become apparent that a smaller command and marshalling center is needed at Hopedale. Use of the command center building constructed during the oil spill is being made available as an oyster and fishing grounds restoration center by the owners. It will serve as a staging area for NRDA evaluation, restoration, and remediation and ongoing environmental research and restoration of oyster reefs and fishing grounds. In addition to the St. Bernard Parish coastal restoration program, a number of non-government conservation organizations, including The Nature Conservancy and the Audubon Society, have expressed interest in utilizing the facility for research, sponsored restoration projects educational program and field trips. It is anticipated that universities and colleges in Southeastern Louisiana will utilize the facility, as well as state agencies such as the Louisiana Department of Wildlife and Fisheries. The facility will become a tangible focal point for coastal restoration. No such facility presently exists in the tidal area of the coastal zone east of the Mississippi river. The large fully functional building is being provided without rental charges. However, operating expenses are needed for utilities, janitorial and routine maintenance, security, etc. are n eeded.	St. Bernard	$200,000
	Culch spreading to stabilize denuded muddy shoreline and near-shore areas and enhance oyster production.	The spreading of cultch on existing bottom reefs and oyster bottoms is an established technique for enhancing oyster productivity. The cultch is usually brought to the deployment area on oyster luggers or barges and washed over the side with a high pressure hose. Clean oyster shells are the preferred material, but crushed and size-graded concrete and other artificial cultch materials may also be used. Because oyster shells are scarce, St. Bernard oyster fishermen have recently begun to use crushed concrete as a substitute material. Large quantities of concrete are available in the St. Bernard area from slabs of homes destroyed by hurricane Katrina. Gravel-sized particles of crushed concrete have proven to be an acceptable substitute for the attachment of oyster larvae. St. Bernard oyster fishermen are a very skilled manpower source for applying cultch at designated sites throughout the shallow water areas of eastern St. Bernard because this is a commonly used method for enhancing oyster production on their privately owned leases.	St Bernard	$4,000,000
	Maurepas Swamp/ Joyce WMA - Lake Maurepas Land Protection Effort	16,000 +/- acres of critically important Louisiana coastal wetlands within the Lake Maurepas/ Pontchartrain Basin. The three targeted tracts are a link into the green infrastructure network already in place across this landscape/ basin. The protection of this acreage will not only provide multiple public benefits, but it will complement at least two multi-million dollar restoration projects to restore hydrology, being led by the U. S. Army Corps of Engineers, and the Louisiana Office of Coastal Protection & Restoration within the Maurepas Swamp.	Livingston	
	Clovelly		Lafourche	$-
	Restoring Small Islands in Barataria Bay: Providing Habitat for Nesting Birds	Bay Ronquille area	Plaquemines	$2,647,540
	Black Lake Marsh Creation		Calcasieu	$-
	Timbalier Bay Abandoned Canal Hurricane Protection	USA	Lafourche, Terrebonne	$-

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Caminada Pass Bridge Fishing Pier Restoration		Jefferson	$
	Terrebonne | Lafourche Barrier Islands Segmented Breakwaters Concept		Lafourche, Terrebonne	$240,000,000
	restoration gulf coast		Jefferson, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Tammany, Tangipahoa	$-
	Fourchon Breakwaters Shoreline Protection	Fourchon-Gulf of Mexico	Lafourche	$-
	Gulf Saver™ Solutions	Venice, LA	Plaquemines	$-
	LL&E South Lafourche Marsh Restoration and Levee Protection	Galliano	Lafourche	$-
	Bayou Pattasat Corridor Improvements	Slidell, LA	St. Tammany	$17,000,000
	EKOgrown™ Native Trees for Barrier Islands Restoration			$10,000-20,000/acre
	Fritchie Marsh Terracing and Marsh Creation	Slidell, LA	St. Tammany	$26,000,000
	Twin Pipeline Canal Ridge Restoration and Fringe Marsh Creation	Midpoint near pipeline canal intersection with Bayou Pointe Au Chien, South of Pointe Au Chien, LA	Lafourche, Terrebonne	$-
	Bayou Bonfouca Marsh Creation	Slidell, LA	St. Tammany	$22,000,000
	Northshore Marsh Creation	Lacombe, LA	St. Tammany	$16,000,000
	Unknown Pass to Rigolets	Orleans Land Bridge	St. Tammany	$12,000,000-24,000,000
	Northshore Marsh Shoreline Repair|Marsh Creation	Slidell	St. Tammany	$2,200,000
	Amite River Diversion	Head of Island, LA	Livingston	$-
	Convent Diversion	Convent, LA	St. James	$-
	Mississippi River Diversion (Hope Canal Area)	Reserve, LA	St. James, St. John the Baptist	$-
	Restoring Finfish of Importance to Louisiana Waters via Private Industry			$-
	PPL20 - Lake Lery March Restoration	Caernarvon, St. Bernard Parish, LA	St. Bernard	$20000000-25000000
	Bayou Chevreuil LA NRDA Response Site	The Site is located within Sections 9, 10, 15, 16, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, and 36, Township 13 South, Range 17 East in St. James and Lafourche Parishes, Louisiana	Lafourche, St. James	$-
	Lake Maurepas Land Protection Effort	Lake Maurepas - Livingston/ Tangipahoa Parishes	Livingston, Tangipahoa	$-

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Atchafalaya Basin Protection Effort	Atchafalaya Basin	Iberville, Pointe Coupee, St. Martin	$-
	ASEG	Gulf Coastline		$-
	Grand Isle and Vicinity Barrier Islands Protection and Enhancement	SE Louisiana	Jefferson, Lafourche	$-
	Lake Pontchartrain Shoreline Restoration		Jefferson, Orleans, St. Tammany, Tangipahoa	$1,000,000
	Bay Jimmy Marsh Restoration	Northern Barataria Bay; Bay Jimmy and surrounding marshes	Plaquemines	$-
	BioWorld Louisiana Gulf Coast Bioremediation	Coastwide	Cameron, Iberia, Jefferson, Lafourche, Plaquemines, St. Bernard, St. Mary, Terrebonne, Vermillion	$2K-6K per ac
	oyster rejuvenation		St. Bernard	$-
	Parish Shoreline Stabilization	East and west bank	Plaquemines	$58,000,000
	Commercial based restoration of finfish of importance to coastal Louisiana	Entire coast	Coastline	$3,000,000
	Calcasieu Pine Savanna	Lake Charles, LA region		$6,800,000
	United Houma Nation Culture Center	Houma, LA	Terrebonne	4.5M to 7MAdmi
	Chef Menteur Restoration	East Orleans Land Bridge	Orleans	$-
	UAV Detection of Residual Oil in Coastal Marshes	Multiple		$-
	Mississippi River Long Distance Sediment Pipeline/Marsh Creation - NRDA Increment	Eastern portion of lower Barataria Basin	Jefferson, Lafourche, Plaquemines	$-
	Lake Hermitage Marsh Creation - EML NRDA Increments	Additional fill areas north of BA-42	Plaquemines	$-
	North Turner's Bay Mitigation Area	North end of Calcasieu Lake	Cameron	$-
	Replenish and Protect Living Coastal and Marine Resources—Birds		Coastwide	$-
	Protection of Natural Resources in the Louisiana Coastal Zone: Risk Assessment of Oil & Gas Wells in Barataria Basin	Barataria Basin, Barataria Bay	Ascension, Assumption, Jefferson, Lafourche, Orleans, Plaquemines, St. Charles, St. James, St. John the Baptist	$910,000
	Synthesis of environmental data in Barataria Basin to assess restoration outcomes	Barataria Basin, Louisiana	Jefferson, Lafourche, Plaquemines, St. Charles, St. John the Baptist	$714,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Adaptive Management with the Native Southern Ribbed-Mussel for a Sustainable Coast	Rockerfeller Wildlife Refuge	Cameron	$-
	Informing Barrier Island and Dune Habitat Restoration by Quantifying Dune Vegetation and Elevation Linkages and Evolution	Barataria barrier islands	Jefferson	$1,716,000
	Plant marsh grass and trees in Louisiana's coastal zone using volunteers	Coastal Louisiana including Northshore of lake Pontchartrain in marsh creation areas.	Cameron, Orleans, St. Tammany, Tangipahoa, Vermillion	$1,050,000
	Vermilion Parish Working Lands, Water and Wildlife Partnership	Vermilion Parish, south of Abbeville, adjacent to the Vermilion River and Intracoastal Waterway	Vermillion	$8,700,000
	The WHARF Project	East of Bayou Segnette and north of Jean Lafitte State Park - the old Westwego Airport	Jefferson	$28,000,000
	Lake Fields and Lake Long Water Qualtiy Restoration Plan	Lake Fields and Lake Long, located east of Bayou Lafourche, south of US Hwy 90, and north of the Gulf Intracoastal Waterway.	Lafourche	$700,000
	Implementation of Nutrient Management Conservation Practices and Innovative Nutrient Reduction Measures on Working Ag Lands in the Ouachita River Basin to Reduce Nutrient Loading to the Gulf of Mexico	Mid to Upper Louisiana Ouachita River Basin	Claiborne, Lincoln, Ouachita, Richland, Tensas	$3,000,000
	Promote public access and recreational use through hydrologic restoration of Bayou Sauvage channel, Bayou Sauvage NWR	Channel of Bayou Sauvage, Bayou Sauvage NWR, Orleans Parish, LA	Orleans	$1,800,000
	Recreational Use Improvements at Barataria Preserve	Jean Lafitte National Historical Park and Preserve - Barataria Unit	Jefferson	$9,350,000
	Coastal Vegetation Types in Louisiana in 2018	Coastal Louisiana	Acadia, Allen, Ascension, Assumption, Cameron, Iberia, Iberville, Jefferson, Lafayette, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Landry, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermillion, Coastwide	$400,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Informing sea turtle restoration and management by creating a baseline health index based on skin microbiomes	Louisiana beaches	Coastwide	$500,000
	Pontchartrain Beach Restoration Plan	south shore of Lake Pontchartrain within New Orleans	Orleans	$2,782,500
	Assessment of impact and development of advanced monitoring techniques for Chandeleur Islands seagrasses	The Chandeleur Islands	St. Bernard	$850,000
	Identifying and prioritizing locations for submerged aquatic vegetation (SAV) restoration/SAV monitoring, prediction and site prioritization	coastal Louisiana across the salinity gradient	Coastwide	$-
	Oyster recruitment and connectivity tool	coastal Louisiana	Coastwide	$-
	Biloxi Marsh Oyster Reef (LA CMP 001.OR.01a)	eastern side of Indian Mound Bay, west side of Chandeleur Sound	St. Bernard	$204,300,000
	New Orleans East Landbridge Restoration - Increment 1	between Lake Borgne/Mississippi Sound and Lake Pontchartrain	Orleans, St. Tammany	$396,000,000
	Bayou Terre aux Boeufs Ridge Restoration (CMP 2017 001.RC.100)	Along Bayou Terre aux Boeufs, between Lake Lery and Black Bay	St. Bernard	$15,100,000
	Bayou la Loutre Ridge Restoration (LA CMP 001.RC.01)	south of Lake Borgne (near Yscloskey) east to near Eloi Bay	St. Bernard	$20,100,000
	Expand and Improve Marine Mammal Stranding Response and Monitoring Capabilities in Louisiana	Louisiana bays, sounds, estuaries, coastal, and offshore waters	Coastwide	$-
	Development of oyster-focused, ecological-support tools for determining restoration potential, benefits, or impacts for Louisiana estuaries	Sabine, Calcasieu, and Sister Lakes, and Barataria Bay	Calcasieu, Cameron, Lafourche, Plaquemines, St. Mary, Terrebonne	$4,300,000
	Bottlenose Dolphin Photo-Identification Studies to Monitor Restoration Effectiveness in Louisiana	Louisiana bays, sounds, estuaries, and coastal waters	Coastwide	$-

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Address gaps and enhance capacity in the current capabilities of the marine mammal stranding network in Louisiana to improve timeliness of response and diagnosis of illness and cause of death	Entire coastline of Louisiana	Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermillion, Coastwide	$-
	Improve the ability of Stranding Network partners to detect and rescue free-swimming marine mammals that are entangled, entrapped or out-of-habitat	Entire coastline of Louisiana	Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Terrebonne, Vermillion	$-
	Monitoring the Response of Shorebirds and their Prey to Louisiana Barrier Island Restoration to Inform a Decision Analytical Framework to Guide Restoration	Coastal Louisiana	Cameron, Iberia, Lafourche, Plaquemines, St. Bernard, St. Mary, Terrebonne, Vermillion	$2,000,000
	Marine Mammal Conservation Aerial Outreach Banners	Coastal Louisiana	Coastwide	$20,000
	Marine Mammal Conservation Print Ads in Tourism & Trade Magazines	Louisiana	Coastwide	$100,000
	Printing and Distribution of Marine Mammal Conservation Outreach Materials & Signs	Coastal Louisiana	Coastwide	$200,000
	Reduce Bycatch of Dolphins in Shrimp Trawls through Characterization of Risk Factors	Louisiana state waters	Coastwide	$550,000
	Improve Bycatch Reduction by Enhancing and Expanding the Gulf of Mexico Shrimp Trawl Fishery Observer Program	Louisiana state waters	Coastwide	$14,100,000
	Protect Wild Dolphin Billboards	Coastal Louisiana	Coastwide	$150,000
	Chandeleur Islands Maintenance and Re-Vegetation	St. Bernard, Louisiana	St. Bernard	$3,500,000
	Systematic Observer Coverage of the Menhaden Fishery to Improve Bycatch Reduction Efforts	Louisiana state waters	Coastwide	$2,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Reduce Dolphin Bycatch in Gillnets through Enhanced Observer Program and Behavioral Observations	Louisiana state waters	Coastwide	$2,500,001
	Evaluate and Implement Trap Pot Gear Modifications to Reduce Dolphin Bycatch	Louisiana state waters	Coastwide	$2,500,002
	Reduce Harm to Dolphins by Determining Scope of Hook and Line Fishing Gear Interactions and Fishermen Attitudes	Louisiana state waters	Coastwide	$2,500,003
	Reducing Bycatch of Bottlenose Dolphins in Louisiana Commercial and Recreational Fisheries	Louisiana state waters	Coastwide	$2,500,004
	Reducing Bycatch of Bottlenose Dolphins in Louisiana Commercial and Recreational Fisheries	Louisiana state waters	Coastwide	$2,500,005
	Increase capacity and infrastructure to improve marine mammal response, rehabilitation, research capabilities, and public awareness along the Louisiana Gulf Coast	Louisiana state waters	Coastwide	$2,500,006
	Increase capacity and infrastructure to improve sea turtle response, rehabilitation, research capabilities, and public awareness along the Louisiana Gulf Coast	Louisiana state waters	Coastwide	$2,500,007
	Adaptive management and decision support tools for oyster reefs and submerged aquatic vegetation in the Gulf of Mexico	Louisiana state waters	Coastwide	$2,500,008
	Bottlenose Dolphin Health Assessments to Monitor Restoration Effectiveness in Louisiana	Louisiana state waters	Coastwide	$2,500,009
	A Marsh Bird Monitoring and Assessment Program for Louisiana	Coastal Louisiana	Coastwide	$-

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Marine Mammal Conservation Medicine and Health Assessment Program	Coastal Louisiana	Calcasieu, Cameron, Iberia, Jackson, Lafourche, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermillion	$-
	Marine Mammal Disaster Response Program for Louisiana	Coastal Louisiana	Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermillion	$-
	Sea Turtle InWater Monitoring and development of Gulf Wide Survey	Louisiana	Coastwide	$2,312,382
	Bottlenose dolphin health assessment program	Louisiana	Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermillion	$-
	New Harbor Island Restoration	New Harbor Island (Breton National Wildlife Refuge)	St. Bernard	$28
	Targeted Enhancement of the Chandeleur Island Chain: An ecosystem approach	Chandeleur Island Chain - Breton National Wildlife Refuge	St. Bernard	$32
	Improving Decision Support Tools for Restoration Planning in the Chandeleur Islands Ecosystem	Chandeleur Islands	St. Bernard	$800,000
	South Louisiana Wetlands Discovery Center	112 Library Drive, Houma, LA 70360	Terrebonne	$8,200,000
	Woodlands Trail Interpretive Center - Belle Chasse, Louisiana	Woodlands Trail, Belle Chasse, Louisiana	Plaquemines	$6,377,110
	Recreational Riverfront Greenway Plaquemines Parish	Woodlands Trail	Iberville, Plaquemines	$6,291,715
	Bayou Terre aux Boeufs Ridge Restoration and Armoring	Delacroix, Louisiana	St. Bernard	$32,500,000
	Bayou La Loutre Ridge Restoration	Hopedale, Louisiana	St. Bernard	$16,500,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Lake Lery Marsh Creation	Delacroix, LA	St. Bernard	$21,000,000
	Louisiana Oyster Cultch (Phase 2)	Hopedale, Louisiana	St. Bernard	$4,078,400
	ACQUISITION AND RESTORATION OF FORESTED WETLANDS IN THE BARATARIA BASIN PLAQUEMINES PARISH	Woodlands Trail	Plaquemines	$5,871,000
	Enhancing capacity for marine mammal stranding response in Louisiana	State of Louisiana	Cameron, Iberia, Jefferson, Lafourche, Plaquemines, St. Bernard, St. Mary, Terrebonne, Vermillion	$2,240,400
	Lower Atchafalaya River outlet canal will generate a new lobe in the Atchafalaya Basin	Below Morgan City installed at Cutoff Island location	St. Mary	$-
	Mississippi Sound Protection Project	Three Mile Bay	St. Bernard	$30,000,000
	Due Diligence for Louisiana Land Conservation	Coastal Louisiana	Coastwide	$150,000
	Fifi Island Ridge	Fifi Island	Jefferson	$7,437,000
	Bayou Lafourche Marsh Creation	Golden Meadow	Lafourche	$30,400,000
	Biloxi Marsh Living Shoreline Project	The proejct would reduce shoreline recession and enhance local oyster production through the implementation of marsh-fringing, bioengineered oyster reefs. The Biloxi Marshes consist of approximately 49,000 hectares of brackish and salt marshes that have been greatly impacted by shoreline erosion from wind-driven waves, with shoreline retreat rates ranging from 1 to 4 meters per year. Up to 11 miles of living shoreline structures will be installed along the project footprint. These shoreline protection features will serve as an important first line of defense for coastal marshes in the project area functioning to help sustain the lower Biloxi Marsh, an important land bridge separating the Gulf of Mexico from Lake Borgne, by helping to prevent and/or reduce the rate of erosion of the marshes and shorelines along the shores of Eloi Bay.	The project area is located along the eastern shore of Biloxi marsh, off the shoreline of Eloi Bay and Eloi Point, near the mouth of Bayou la Loutre.	$57,700,000
	West Grand Terre Beach Norishment and Stabilization	This project would address gulf shoreline erosion, diminished protection against storm surge, and subsidence of back barrier marshes, as well as restore dune and back barrier marsh habitat on West Grand Terre to provide storm surge and wave attenuation. The project is estimated to build approximately 14,000 feet of beach and dune with an area of 251 acres using 1,750,000 cubic yards of material. Up to 160 acres of back barrier marsh will be restored using 1,100,000 cubic yards of material. A rock revetment will be constructed to protect restored marsh and a rock revetment spur will capture sand transported by longshore currents. The project also requires the removal of existing structures that are located within the project footprint and impact the beach and dune section.	This project is located in Jefferson Parish immediately northeast of Grand Isle at the mouth of Barataria Bay extending approximately 4.3 miles from Barataria Pass to Pass Abel.	$93,300,000

Agency/Entity/ Person	Project Title	Project Description/ Summary	Project Location	Estimated/Proposed Project Cost
	Golden Triangle Marsh Creation Project	The Golden Triangle Marsh Creation Project (PO-0163) is estimated to create and/or nourish up to approximately 600 acres of the existing brackish marsh in the Golden Triangle area to create new wetland habitat, restore degraded marsh, and reduce wave erosion. This project would also create important habitat for a wide variety of fish and wildlife species. Many of these species support recreationally- and commercially-important fishing and hunting industries.	The Golden Triangle is located approximately seven (7) miles east of the City of New Orleans, Louisiana and is situated in both Orleans and St. Bernard Parishes. It is bounded to the north by the Gulf Intracoastal Waterway (GIWW), to the south by the Mississippi River Gulf Outlet (MRGO), to the west by Lake Borgne and to the east by both the Lake Borgne Surge Barrier and the confluence of the MRGO and GIWW.	$54,300,000
	Rawhead Island Living Shoreline Protection Project	Project Description: Coastal Environments, Inc and partners propose to fabricate and install bio-induced oyster reefs to stabilize shorelines and help restore and sustain valuable and sensitive estuarine ecosystems and to prevent segmentation of Rawhead Island and exposure of fragile shoreline to open water and tidal erosion. Rawhead Island is recognized by the Louisiana Department of Wildlife and Fisheries as a historic bird rookery. This project will stabilize approximately 1700' of shoreline by installing cost-efficient and effective vertical breakwater technology called ReefBlk. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bio-engineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion. Additionally, concrete aggregate cultch may be spread 4-8 inches deep from a point approximately 50' offshore up to the bank with the typical marsh edge sub-tidal undercut filled by cultch or bags of cultch to prevent sloughing of marsh edge. Preliminary Data: Salinity: 12.3ppt Depth and Bottom Consistency Measurements: Shoreline 0.8ft Hard (Break in Shoreline) 5ft 1.2ft Hard 25ft 2.5ft Med Hard 50ft 2.9ft Med Hard 100ft 4.2ft Med Soft These proven living shoreline and erosion control methods are currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent oyster grounds and leases, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The overall goals of the project include reef construction, shoreline stabilization, marsh regrowth, and faunal utilization. Fabrication and staging for the projects will occur in St Bernard Parish creating jobs to offset the negative economic impact suffered by the commercial fisheries industry of the parish. The oyster is the keystone organism for the estuary, and the vertical reefs will contribute spat to nearby oyster leases and increase the robustness of the marine habitat in general. Organization Name:Coastal Environments Inc for St. Bernard Parish. This project also falls within the goals and objectives of The Nature Conservancy as submitted under NRDA for Louisiana. Activity(s): Protection Restoration Maintenance/Management Habitat(s): Subtidal (Nearshore/Offshore) Marine/Estuarine Wetlands Status Property/Resource Acquisition: Procedure and legal requirements established in previous projects; would initiate upon request or with approval of project. Project Planning/Design: Preliminary water bottom, salinity and geological analysis performed. Project Permitting: Procedure and legal requirements established in previous projects; would initiate upon request or with approval of project. Time to Implementation: 3-5 months Time to Project Completion: 1-2 years Included in Master Plan? Yes Cost Estimated Cost: US$1,200,000 Funding Available: Partners: Organization The Nature Conservancy as potential partner	St Bernard	$36,000,000
	Treasure Bay Living Shoreline Stabilization Project	The project will stabilize approximately 3300' of shoreline by creating intertidal oyster reef habitat using ReefBlk units and the application of #57 concrete aggregate as cultch 4-8" thick to a distance between 50-100' from the shoreline. The ReefBlk units and cultch function as substrate for oyster spat attachment and allow growth of an intertidal reef. The project shoreline received heavy oiling in the MC 252 event. This project will stabilize impacted shoreline of this critical geologic framework feature which influences hydrologic conditions in the highly productive oyster grounds of Christmas Camp Lake and Treasure Bay; it also buffers the southern Biloxi Marsh from open water conditions and provides storm surge protection for St Bernard Parish. This project can be considered 75% shovel ready. Staging and logistics for the project are in place at the current ReefBlk operation at Hopedale, Louisiana now servicing The Nature Conservancy project for Lake Eloi and Lake Fortuna. Coastal permits obtained and landowner protocol agreements developed for The Nature Conservancy's nearby Lake Eloi project create a simple template to obtain the necessary permits for this project within four months. All current production activities can be expanded quickly to implement this project. Coastal Environments, Inc and partners will fabricate and install bio-induced oyster reefs to stabilize shorelines and help restore and sustain valuable and sensitive estuarine ecosystems in the Biloxi Marsh. This project will stabilize the shoreline by restoring intertidal oyster reef habitat using a cost-efficient and effective vertical breakwater technology called ReefBlk. The ReefBlk units function as a substrate for oyster spat attachment and allow growth of an intertidal oyster reef that provides both shoreline protection and habitat for estuarine organisms. As oyster growth progresses and the reef unit becomes more dense, the bioengineered structure dampens and dissipates wave energy and protects the estuarine marsh from erosion. These proven living shoreline and erosion control methods are currently inducing the growth of bio-engineered and self-sustainable living oyster reefs that expand both linearly and vertically to buffer wave action and retard erosion along estuarine shorelines in Texas, Louisiana, Alabama and Florida. High vertical profile oyster reefs also enhance species habitat diversity and provide oyster larvae for recruitment to adjacent oyster grounds and leases, thus increasing an area's economic value as related to commercial and recreational fishing, oyster harvesting and ecotourism. The proposed use of cultch to armor the shoreline through oyster shell accretion and deposition within the ReefBlk area will add to the proven benefits of ReefBlk. The oyster is the keystone organism for the estuary, and the vertical reefs will contribute spat to nearby oyster leases and increase the robustness of the marine habitat in general. Fabrication and staging for the project will occur in St Bernard Parish creating jobs to offset the negative economic impact suffered by the commercial fisheries industry of the parish. This project will be a part of the overall scope of education and research contemplated for the Oyster Research Center at Hopedale, which is also listed under NOAA NRDA projects. The project is a specific element of the shoreline stabilization NRDA request submitted by The Nature Conservancy.	St Bernard	$27,000,000

APPENDIX C

Best Management Practices and Conservation Measures

The best management practices (BMPs) presented in this appendix could be implemented to minimize or avoid potential impacts to resources during implementation of activities or post-construction for alternatives under consideration in the *Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat* (RP/EA).

GEOLOGY AND SUBSTRATES

Specific measures would be implemented during construction to minimize erosion and overall soil impacts. To the extent possible, the alternatives would use the existing development footprints and disturbed areas (e.g., parking areas). These would include following established BMPs for construction activities such as the implementation of an erosion control and stormwater management plan, the installation of sediment traps prior to commencement of construction activities, and ongoing construction monitoring to ensure compliance. In-water work, such as construction marshes, oyster reefs or breakwaters, would be performed behind silt curtains to isolate construction impacts.

HYDROLOGY AND WATER QUALITY

Pollution prevention plans would be prepared as necessary, in conjunction with the National Pollutant Discharge Elimination System permitting process prior to construction. These plans would include all specifications and BMPs necessary for control of erosion and sedimentation due to construction-related activities. The construction BMPs, in addition to other avoidance and mitigation measures as required by state and federal regulatory agencies, would minimize water quality and hydrology impacts.

AIR QUALITY

Emission-reduction measures to mitigate for short-term air quality impacts could include using ultra-low-sulfur diesel fuel in off-road construction equipment, limiting unnecessary idling time of diesel-powered engines, controlling dust related to construction site activities, and covering trucks hauling loose materials.

NOISE

Measures that serve to limit noise impacts to humans from construction activities include the following:

- Limiting activity at alternatives to daytime hours
- Limiting truck traffic ingress/egress to the site to daytime hours
- Promoting awareness that producing prominent discrete tones and periodic noises (e.g., excessive dump truck gate banging) should be avoided as much as possible
- Requiring that work crews seek pre-approval for any weekend activities or activities outside of daytime hours
- Timing of in-water noise-producing activities to minimize disturbances to marine life
- Implementing standard practices, such as muffle units for generators, during construction operations to mitigate noise impacts

ESSENTIAL FISH HABITAT

Measures that serve to mitigate impacts to essential fish habitat (EFH) include the following:

- When impacts cannot be avoided, BMPs would minimize the magnitude and duration of impacts to aquatic fauna, EFH, and managed species.
- Evaluation of impacts to EFH would continue during engineering and design (E&D) to determine the extent of permanent impacts and any necessary offsets for these impacts.
- Signage, fencing, or landscaping can be used to focus foot and boat traffic to certain areas, thereby limiting shoreline and nearshore disturbances.
- BMPs during construction would likely include time-of-year restrictions for any in-water work (e.g., boardwalk construction) to avoid and minimize impacts to protected and managed species when they are expected to be present or when most vulnerable.
- BMPs during construction would also likely include standard erosion and sediment control measures (e.g., silt fence) to protect water quality and aquatic habitats from impacts resulting from construction stormwater and sediment runoff. Project design standards could include no net increase in stormwater runoff and associated pollutants.
- Unavoidable impacts to jurisdictional wetlands and waters would be mitigated, if necessary.
- EFH consultation guidance documents on the National Marine Fisheries Service (NMFS) webpage may provide additional BMPs to avoid or limit alternative impacts to EFH (NOAA Fisheries 2018).

CULTURAL RESOURCES

Measures that serve to mitigate impacts to cultural resources include the following:

- Cultural and historic resources would be considered when preparing site-specific restoration measures and management actions.
- Where there is a likelihood of disturbance of cultural resources, cultural resource managers would conduct appropriate surveys to assess the methods and location of restoration and management actions.
- Restoration measures and management actions would be designed to avoid cultural resources to the extent practicable.

INFRASTRUCTURE

Measures that serve to mitigate impacts to general infrastructure include the following:

- Erosion- and sedimentation-control measures, including minimizing the amount of clearing and exposed soil, would be implemented and maintained.
- Sedimentation controls would be installed prior to the start of construction and maintained throughout the construction period.
- Disturbed areas would be revegetated with native species as soon as possible after work has been completed.

Measures that serve to mitigate impacts to pipeline infrastructure include the following:

- The Contractor will notify all utility operators and pipeline companies at least 72 hours in advance of any work at the restoration area and at least four 4 weeks in advance of any work within/crossing the conveyance corridors.
- All pipelines located within 150 feet of the containment dike alignment, borrow channel alignment, access channels, rock revetment alignments, and beach/dune and marsh fill areas and any pipelines crossing the conveyance corridors will be probed by the Contractor for depth and their locations marked prior to excavation, dredging, and installation of the sediment pipeline, for the duration of construction activities in accordance with technical specifications.
- No excavation shall be permitted within 50 feet of any pipeline in the vicinity of the containment dike alignment, borrow channel alignment, access channels, rock revetment alignments, and beach/dune and marsh fill areas.
- The Contractor shall notify all pipeline companies or current pipeline right-of-way permit holders near the borrow areas, containment borrow channel, and access channels at least 4 weeks in advance of any dredging or excavation so that the pipeline companies or right-of-way permit holders may take precautions to mark its pipeline segments if they choose to do so.
- No dredging or bottom disturbing activities (including anchoring or spudding) may take place within 500 feet of any existing pipeline near the borrow areas.
- Any anchoring within the allowable anchor areas near pipeline crossings shall be in accordance with the oil/gas pipeline owner crossing agreements obtained by the Contractor. If no anchoring restrictions are defined in the crossing agreement for a particular pipeline crossing a conveyance corridor, then no anchoring shall be allowed within 250 feet of said pipeline.
- All equipment operation within the Restoration Area shall maintain at all times a minimum of 10 feet of clearance from the top of the equipment and the overhead electrical transmission lines. If for any reason the Contractor feels that this requirement cannot be met, then all equipment shall remain a minimum of 100 feet horizontally from the overhead electrical transmission lines and the Contractor should immediately notify the owner and engineer (Coastal Protection and Restoration Authority of Louisiana 2019).

PUBLIC HEALTH AND SAFETY

Measures that serve to mitigate impacts to public health and safety include the following:

- Caution would be taken to prevent spills of oils and grease if handling fuels onsite.
- Spill mitigation measures would be employed immediately following a spill of any hazardous material.
- The load compartments of trucks hauling dust-generating materials would be covered.
- Heavy water spray or chemical dust suppressant would be used in exposed areas to control airborne dust.
- Any produced waters or human waste would not be discharged unless the Department of Health and Hospitals requirements are met or exceeded.
- Flood access and evacuation plans would be filed on-site.
- The resiliency of the proposed structures to sustain sea-level rise, hurricanes, and storm surges would be determined during final design.

LITERATURE CITED

Coastal Protection and Restoration Authority of Louisiana. 2019. Provisions and Specifications for West Grand Terre Beach Nourishment and Stabilization Project (BA-0197) Jefferson and Plaquemines Parishes, Louisiana. June 2019.

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APPENDIX D

Monitoring and Adaptive Management Plans

Monitoring and Adaptive Management Plan for *Deepwater Horizon* NRDA Project:

WEST GRAND TERRE BEACH NOURISHMENT AND STABILIZATION (BA-0197)

Prepared by: Todd Folse, Coastal Protection and Restoration Authority of Louisiana

Draft Version Date: 11/18/2019

Table of Contents

1 Introduction

The Deepwater Horizon (DWH) Louisiana Trustee Implementation Group (TIG)[1] developed this Monitoring and Adaptive Management Plan (MAM Plan) for the West Grand Terre Beach Nourishment and Stabilization Project (Project) which was engineered and designed utilizing funds from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act). This Project will be constructed using funds associated with the Natural Resource Damage Assessment (NRDA). The purpose of this MAM Plan is to identify monitoring activities that will be conducted to evaluate and document restoration effectiveness, including performance criteria for determining restoration success or need for interim corrective action (15 CFR 990.55(b)(1)(vii)). Where applicable, the MAM Plan identifies key sources of project uncertainty and incorporates monitoring data and decision points that address these uncertainties to ensure that restoration objectives are met, and project benefits are maximized. It also establishes a decision-making process for making adjustments where needed.

There are three primary purposes for MAM Plans:

1. Identify and document how restoration managers will measure and track progress towards achieving restoration goals and objectives;
2. Increase the likelihood of successful implementation through identification, before a project begins, of potential corrective actions that could be undertaken if the project does not proceed as expected;
3. Ensure the capture, in a systematic way, of lessons learned or new information acquired that can be incorporated into future project selection, design, and implementation.

The MAM Plan is a living document and will be updated at the end of construction, just prior to the implementation of the monitoring activity in order to provide more specificity and to incorporate any changes that may have occurred during final engineering and design and/or construction. The MAM Plan may also be updated during the monitoring phase of the project, as needed, to reflect changing conditions and/or new information. For example, the MAM Plan may need to be revised should the project design change, if initial data analysis indicates that the sampling design requires adjustment, or if any uncertainties are resolved or new uncertainties are identified during project implementation and monitoring. Any future revisions to the MAM Plan will be made publicly available through the

[1] The LA TIG includes the following members: Louisiana State Trustees include the Louisiana Coastal Protection and Restoration Authority (CPRA); Louisiana Department of Environmental Quality (LDEQ); Louisiana Department of Wildlife and Fisheries (LDWF); and Louisiana Department of Natural Resources (LDNR); Louisiana Oil Spill Coordinator's Office (LOSCO).Federal Trustees include Department of the Interior (DOI), the National Oceanic and Atmospheric Administration (NOAA), United States Environmental Protection Agency (USEPA), and United States Department of Agriculture (USDA).

Restoration Portal (https://www.diver.orr.noaa.gov/web/guest/home) and accessible through the Deepwater Horizon NRDA Trustees website (http://www.restoration.noaa.gov/dwh/storymap/).

1.1 Project Overview

The West Grand Terre Beach Nourishment and Stabilization Project is located in southeastern Jefferson Parish, Louisiana, east of the only inhabited barrier island, Grand Isle (**Figure 1**). The Project's selected alternative for construction features 251 acres of beach and dune that provides 14,100 linear feet of shoreline protection and 160 acres of intertidal marsh, and 5,880 linear feet of rock revetment shoreline protection. The constructed target elevations for the various project features are (CEC 2019b):

- dune feature at +8.0 feet NAVD88
- beach feature at +6.0 feet NAVD88
- marsh elevation at +2.0 feet NAVD88
- rock revetment shoreline protection feature elevation ranges between 6.5 and 2.5 feet NAVD88

The borrow area is located approximately 4.6 nautical miles east-southeast of the center of West Grand Terre Island in State waters (CEC 2019a and b). Upon completion of the project, suitable native herbaceous vegetation will be planted on the dune feature. At year 2 or 3 post-construction, vegetation monitoring data along with visual observations will determine the need for a vegetative planting effort on the marsh platform. The project is currently in the engineering and design phase and a 95% Design Report has been completed.

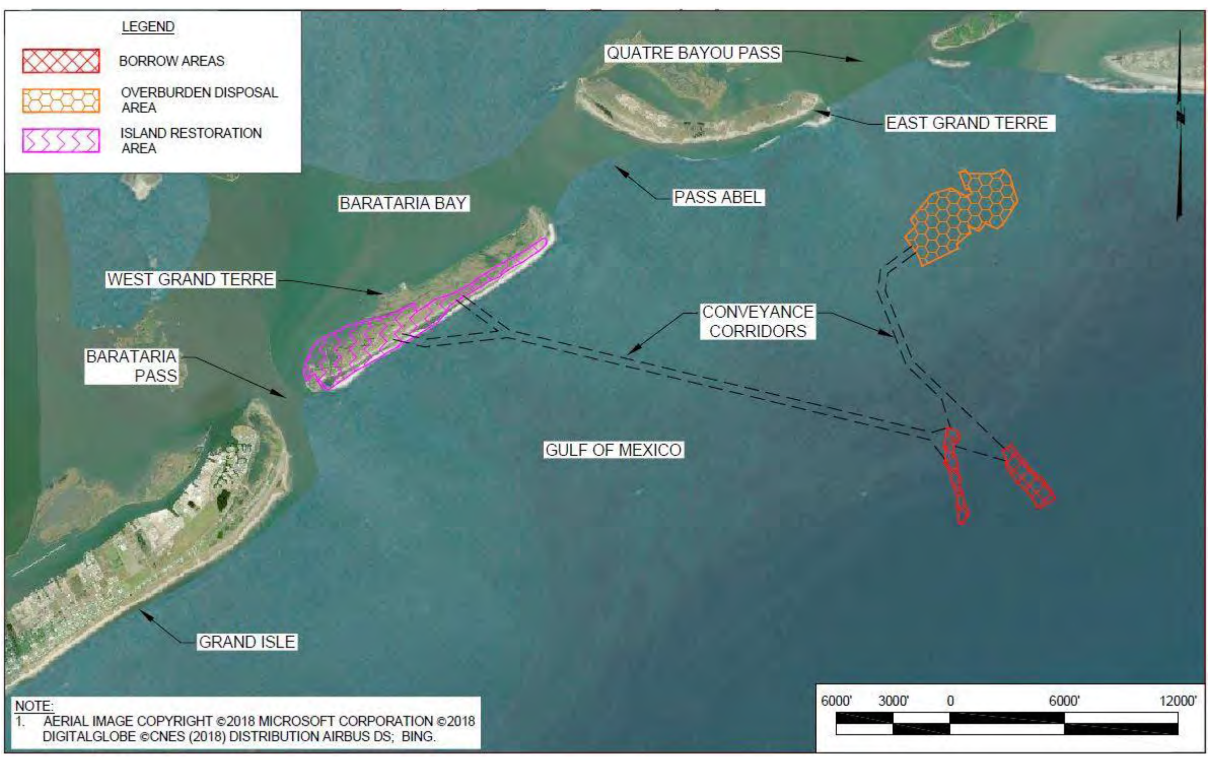

Figure 1. Project location map including the restoration site, borrow area, and pipeline corridor (CEC 2019a).

This project is being implemented as restoration for the *Deepwater Horizon* oil spill (DWH oil spill) Natural Resource Damage Assessment (NRDA), consistent with the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS) (Deepwater Horizon Natural Resource Damage Assessment Trustees. 2016). Per the PDARP/PEIS, the project falls into the following restoration categories:

- **Programmatic Goal:** Restore and Conserve Habitat
- **Restoration Type:** Wetlands, Coastal, and Nearshore Habitats
- **Restoration Approach:** Create, Restore, and Enhance Coastal Wetlands
- **Restoration Technique**: Create or enhance coastal wetlands through placement of dredged material
- **Trustee Implementation Group:** Louisiana TIG
- **Restoration Plan:** Deepwater Horizon Oil Spill Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat

The implementing state trustee is the Coastal Protection and Restoration Authority (CPRA) of Louisiana. The lead federal trustee is the United States Environmental Protection Agency.

1.2 Restoration Type Goals and Project Restoration Objectives

The goal for the Project is to create and restore wetlands, coastal and nearshore habitats in the Louisiana Restoration area specifically on West Grand Terre Island (LA TIG 2017). This area has been degraded due to eustatic sea level rise, high subsidence rates, diminished sediment supply, and extreme storm events. In restoring these coastal habitats, the Trustees envision that the Project will compensate, in part, for wetlands, costal, and nearshore habitat losses associated with the DWH oil spill.

1.2.1 Restoration Type Goals

As summarized in Chapter 5 of the PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

- Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- Restore habitats in appropriate combinations for any given geographic area.

1.2.2 Project Restoration Objectives

To help meet the restoration goals for injuries to coastal habitats, the project restoration objective is to create ~251 acres of beach and dune habitat, create ~160 areas of intertidal marsh habitat, and protect the intertidal marsh habitat from erosion by using rock revetment as shoreline protection. The degree to which this restoration objective is met will be evaluated via measurements of the following parameters:

- Parameter #1: Spatial Extent (acres) of project and island
- Parameter #2: Elevation of project area and island system
- Parameter #3: Vegetative Cover

- Parameter #4: Shoreline Position
- Parameter #5: Water Level

These parameters will be monitored according to the monitoring schedule summarized in Section 2.

Throughout the design process, project team members, including the CPRA and the USFWS will have the opportunity to refine design parameters as additional information becomes available. Performance criteria will be identified/implemented to determine restoration success or the need for corrective action in accordance with 15 CFR 990.55(b)(1)(vii)). Specific, measurable performance criteria are defined for monitoring parameters associated with each of the restoration objectives in Section 5.0.

1.3 Conceptual Setting

The West Grand Terre Beach Nourishment and Stabilization Project is located in Jefferson Parish, Louisiana east of Grand Isle, Louisiana. Coastal erosion, sea level, and tropical weather, i.e., hurricanes, have caused significant degradation to the island. Beach, dune, and marsh creation projects like the one proposed here may help to build and maintain these habitats over time. The conceptual setting for the West Grand Terre project is summarized in Section 3.2.1 of this RP/EA, and is incorporated here by reference.

1.3.1 Potential Sources of Uncertainty

Although the likelihood of project success is evaluated under the OPA regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated (e.g., sediment compaction or vegetation success). For the West Grand Terre Beach Nourishment and Stabilization project, the uncertainties (summarized in **Table 1)** could affect project success, and could therefore be key drivers of corrective actions or adaptive management decisions. Sections 2-3 summarize project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve stated project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to PDARP/PEIS Restoration Type MAM sections (Deepwater Horizon Natural Resource Damage Assessment Trustees. 2016), Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0 (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017), and other documents. Select monitoring activities can then be implemented to inform these uncertainties and to select appropriate corrective actions in the event the Project is not meeting its performance criteria (**Table 1**).

Table 1. Key Uncertainties

Reference Number	Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
1	Sea level rise and subsidence	Increased water levels would reduce the ability of the beach and dune as a protection feature and expose it to more wave action which could potentially remove sediment out of the system. Increase water levels in the marsh habitat would increase the depth and duration of flooding of backbarrier plant species and cause stress.
2	Sediment compaction	Increased sediment compaction would reduce the elevation making the dune, beach, and marsh more susceptible to increased water levels.
3	Success of vegetation establishment/plantings	Lack of vegetation establishment/planting success would limit or delay the creation of the desired habitat and allow for sediments to be windblown
4	Frequency of tropical weather	Project was designed for historical average tropical weather. Increase activity or increase intensity of storm(s) would negatively affect the project by accelerated loss in elevation and sediments.

2 Project Monitoring

The MAM Plan was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed, for the first 5 years after the project's construction. The data collected during this 5 year period will also be used to predict the project's performance during the remaining 15 years of the project's design life. For each of the identified monitoring parameters, information is provided as to their intended purpose (e.g., monitor progress toward meeting one or more of the restoration objectives, support adaptive management of the project, etc.), monitoring methods, timing and frequency, duration, sample size, and sites. Further, these parameters will be monitored to demonstrate how the restoration project is trending toward the performance criteria and to inform the need for corrective actions (see Section 5, Project-Level Decisions).

The *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017) recommends project-level monitoring be conducted at reference or control sites. The CPRA currently maintains a monitoring program that provides data and research to support the planning, design, construction, evaluation, and adaptive management of Louisiana's barrier/sandy shoreline restoration projects (Kindinger et al 2013). This Barrier Island Comprehensive Monitoring (BICM) program was developed and implemented to improve the State's ability in evaluating it's sandy shorelines. Various types of data and products are generated from this endeavor. Documents summarizing both data collection efforts and products generated from these efforts as well as other available data can be found at https://cims.coastal.louisiana.gov/DocLibrary/DocumentSearch.aspx?Root=0&Folder=0# . BICM data and products will serve as reference material for this project. It is difficult to find reference areas for barrier island projects since restoration efforts have occurred on most, if not all, barrier islands in coastal Louisiana. Data may be examined from other barrier island projects to see how they performed at the same time intervals after construction, if data is available.

Though additional measures may be implemented to more fully characterize the Project's effectiveness, the LA TIG proposes the continued implementation of proven and established monitoring methodologies to monitor project success:

- Parameter #1: Spatial Extent (acres) of project and island
  a) Purpose: To determine the habitat types and acres of each identified habitat within the project boundary as well as the entire island over time
  b) Method: Using geo-rectified aerial imagery, habitat maps will be generated using an object-based classification approach in the Trimble eCognition software or equivalent. The habitat classification scheme will be the same as that used for the BICM program (Enwright et al. *In Press*) allowing integration and comparison of multiple datasets if needed.
  c) Timing, Frequency, and Duration: Aerial imagery will be acquired in the Fall immediate post-construction/as-built to represent year (YR) 0; Years (YRs) 3 and 5 post-construction - will occur during the Fall of the respective years
  d) Sample Size: Aerial imagery will be acquired for the entire West Grand Terre island which is larger than the project boundary
  e) Sites: West Grand Terre island

- Parameter #2: Elevation of project area and island system
  a) Purpose: To determine the average elevation and footprint of the dune, beach, and marsh over time
  b) Method: LiDAR and/or RTK topographic surveys occupying a minimum of the existing BICM program survey lines to allow integration and comparison of multiple datasets if needed.
  c) Timing, Frequency, and Duration: Surveys will be conducted YR 0 (as-built), and YRs 3 and 5 post-construction
  d) Sample Size: See Figure 2 for monitoring extent. All transects presented in **Figure 2** will be surveyed in YRs 0 and 5. In YR 3, only the BICM transects will be surveyed.
  e) Sites: See **Figure 2**

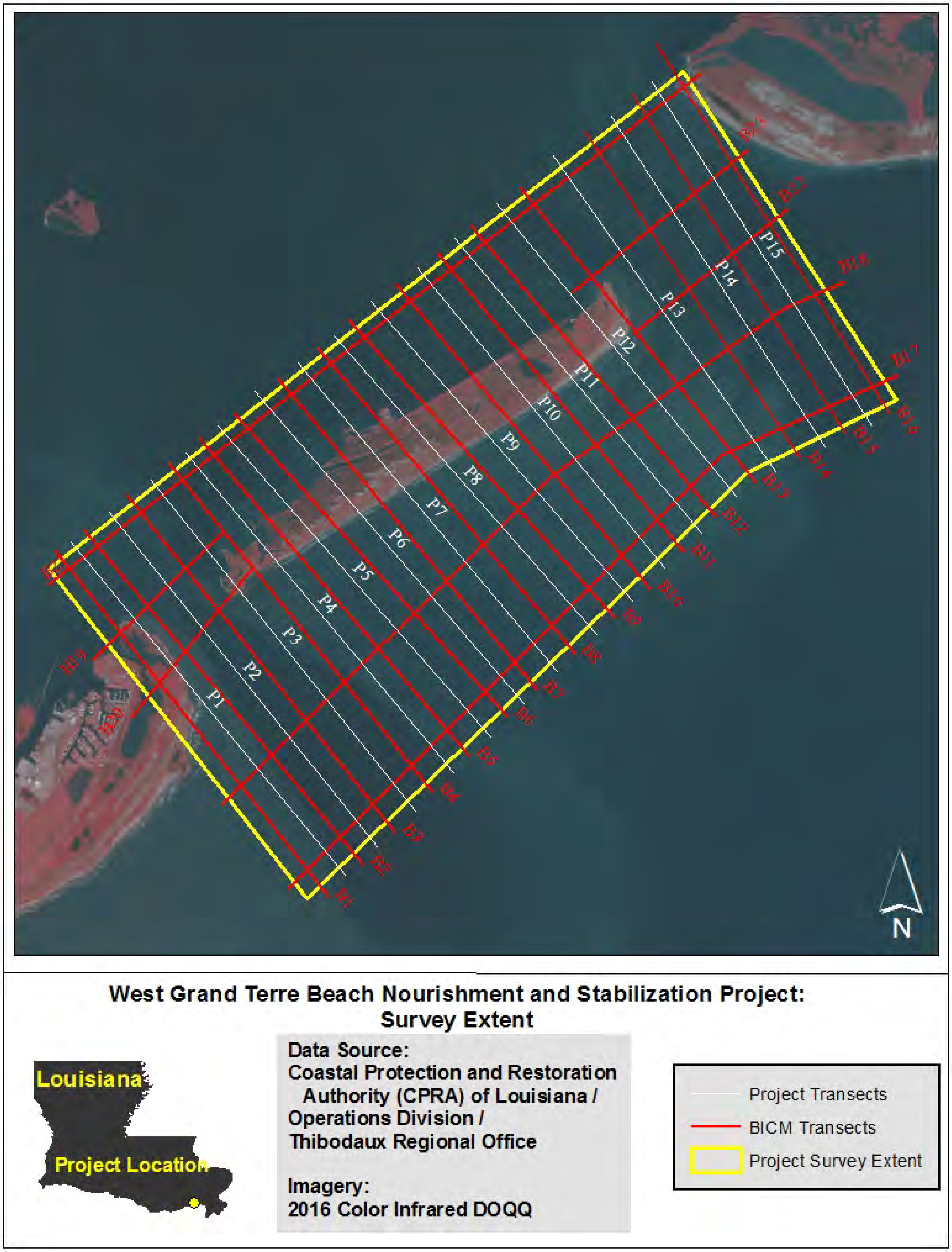

Figure 2. Survey extent and transect lines for bathymetric and topographic survey.

- Parameter #3: Vegetative Cover
  a) Purpose: To determine the vegetative composition and percent cover in the various habitats in the project area and island over time
  b) Method: Ocular estimates of percent cover of each species identified, height measurements of the dominant species, and percent cover of the carpet, herbaceous, shrub, and tree layers, if present, within a 2 meter by 2 meter plot (Folse et al. 2018) randomly placed along the BICM 1,500 foot bathymetric transects lines that were extended across the island throughout the project area and island (Hester and Willis 2015).
  c) Timing, Frequency, and Duration: YR 1 – after first growing season after any planting effort or after the completion of the project, YRs 3 and 5 post-construction. Sampling will occur between mid-August and mid-November with the target being September/October.
  d) Sample Size: A minimum of 5 randomly placed stations along 10 transects
  e) Sites: West Grand Terre island

- Parameter #4: Shoreline Position
  a) Purpose: To delineate the shoreline position and determine changes to island extents
  b) Method(s): Aerial imagery shoreline digitization following the BICM program methods (Byrnes et al. 2018) or survey data MHW lines or a combination thereof
  c) Timing, Frequency, and Duration: After construction is completed, i.e., YR 0 (as-built), and YRs 3 and 5 post-construction
  d) Sample Size: Entire West Grand Terre island shoreline
  e) Sites: West Grand Terre island

- Parameter #5: Water Level
  a) Purpose: To determine the inundation of the marsh platform over time
  b) Method: Using existing water level gauges and the average elevation of the marsh platform from the survey data, inundation calculations will be performed
  c) Timing, Frequency, and Duration: YRs 3 and 5 survey data will be used but all available water level data will be used which is hourly collections
  d) Sample Size: Hourly data from the time of construction to the end of monitoring
  e) Sites: NOAA Grand Isle Station 8761724 which is located on the eastern tip of Grand Isle and CRMS0178 which are approximately 1 mile and 6 miles respectively from the marsh platform of the project area

3 Adaptive Management

Monitoring information collected at the project-level can also inform adaptive management (a form of structured decision-making applied to the management of natural resources in the face of uncertainty of that individual project) (Pastorok et al. 1997; Williams 2011). Within the LA TIG, an adaptive management framework has been developed that identifies and characterizes the four main phases along with the ten steps for adaptive management which are illustrated within a representative adaptive management cycle (**Figure 3**).

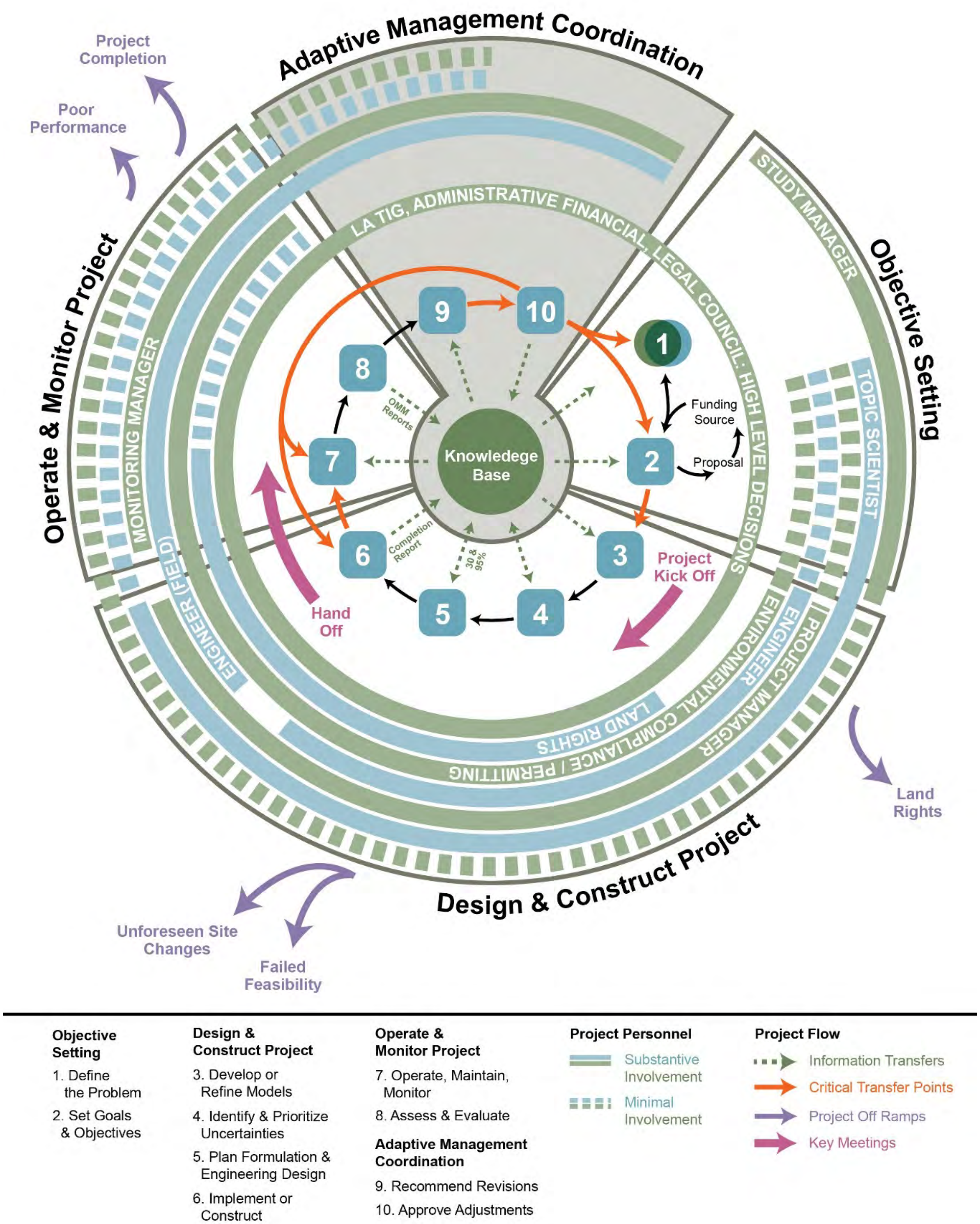

Figure 3. LA TIG Adaptive Management Cycle (Source: The Water Institute of the Gulf. 2019).

1. <u>Objective Setting Phase</u>: Problem is identified or defined and project goals and objectives are established based on multiple sources, including lessons learned, data and associated synthesis, and applied research from previous projects and from the knowledge base as a whole. For the West Grand Terre Beach Nourishment and Stabilization project, the goal setting phase is already complete – the problem of beach and back-barrier marsh loss has been defined through the PDARP/PEIS as well as through Louisiana's Coastal Master Plan process, and the goals and objectives of restoration are as described in the restoration plan that accompanies this MAM plan.
2. <u>Design and Construct Phase</u>: Project advances through select steps, including model development or refinement, identification and prioritization of uncertainties, plan formulation, engineering, design, and project construction. For the West Grand Terre Beach Nourishment and Stabilization project, the elements of a preliminary design have already been described within the Restoration Plan, incorporating available data on water depths, intertidal range for nearby marsh, and local subsidence rates. As the project advances to more advanced phases, the design may be modified as needed to incorporate any new information that could affect the preliminary design.
3. <u>Operate and Monitor Phase</u>: Project's operations, maintenance, and monitoring plans are developed and project assessment and evaluation criteria are identified. Note that for this and other beach nourishment and stabilization projects, the opportunities for adaptive management post-construction may in some cases be limited. For example, if the dune and/or marsh platform does not achieve the proper elevation post-settlement, re-mobilizing a dredge to modify the marsh platform elevation is generally cost-prohibitive. However, supplemental vegetative plantings can be used to improve vegetative cover if the marsh platform is already at the proper elevation and stabilize the dune.
4. <u>Adaptive Management Coordination Phase</u>: Encompasses steps for recommending and approving project revisions so that revisions can achieve one or both of the following:

    - Result in alterations and redesign of project elements or changes to project operation
    - Provide input to either the understanding of the overall problem statements or the refinement of attainable or realistic goals and objectives for future projects

4 Evaluation

Evaluation of monitoring data is needed to assess the project implementation and performance in meeting restoration objectives, resolving uncertainties to increase understanding, and determining whether corrective actions are needed.

As part of the larger decision-making context, the evaluation of monitoring data from individual projects could also be compiled and assessed at the restoration type and LA TIG level, and the results would be used to update the knowledge base to inform decisions such as future LA TIG project prioritization and selection, implementation techniques, and the identification of critical uncertainties. Reports, presentations, and/or lesson learned meetings are potential avenues of transferring information to the LATIG and other agency personnel about project performance.

The results of these analyses would be used to answer the following questions and included within the reports described in Section 8 of this plan:

- Were the project restoration objectives achieved? If not, is there a reason why they were not met?
- Did the restoration project produce unanticipated effects?
- Were there unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

Proposed analysis methods are grouped by monitoring parameters:

Parameter #1: Spatial Extent (acres) of project and island

Analysis: Aerial imagery will be used to perform a habitat classification analysis using the protocol set forth by the BICM program. The current habitat mapping procedure uses any available elevation data to assist in the classification of some habitats. The habitat mapping results will be examined by project area and entire island. Using multiple time periods, changes in quantity and type of each habitat will be evaluated. Per the performance criteria, 94% of the project area should be classified as some type of ecological habitat (beach, dune, marsh, scrub/shrub) other than water at year 5. The project's change rate will be compared to other change rates of similar time periods for other regions in coastal Louisiana, if available. Additionally, the island's change rate will be compared to pre-project change trends as well.

Parameter #2: Elevation of project area and island

Analysis: The project's Final Design Report will establish the desired elevation of each habitat feature, i.e., +8.0 feet NAVD88 for dune, +6.0 feet NAVD88 for beach, and +2.5 feet NAVD88 for marsh. Data will be processed to create digital elevation models (DEM) to determine the average elevation within each habitat classified during the habitat mapping effort. Results will be compared to both initial design elevations as well as pre-restoration elevations and change trends. Elevation models generated to show the elevation across the project area and island can also be used to determine elevation changes as well as changes in volume of sediment, allowing change trends to be developed and compared to pre-project trends.

Parameter #3: Vegetative Cover

Analysis: General descriptive statistical analyses may include, but are not limited to, averages/means of the overall total cover by herbaceous species and/or shrubs (marsh); percent cover of species; and/or average height of dominant/species. After each collection effort, the data will be analyzed and evaluated. In conjunction with the habitat mapping, the vegetation data will provide on the ground verification of the habitat mapping effort and provide insight into the species composition and percent cover of those delineated habitats. After multiple collection efforts, comparisons between each time period will be assessed to determine changes.

Vegetation results are not directly tied to a performance criteria. Vegetation data is being collected to inform the habitat mapping effort and to provide insight into the evolution of constructed barrier islands vegetative component as well as determining potential planting scheme for future barrier island restoration projects.

Parameter #4: Shoreline Position

Analysis: Shoreline position can either be delineated from aerial imagery or elevation data. It has not been determined yet which method will be used; however, the shoreline position will be comparable with BICM program data to allow comparisons with historic datasets. Shorelines will be developed at YR 0, 3, and 5. Change rates will be calculated from those three (3) time periods and compared to other data sets for islands in the vicinity of the project as well as regional and coast-wide changes. These data sets are provided through the BICM program or other literature.

Parameter #5: Water Level

Analysis: Hourly water level data will be download from the stations and processed to insure comparable datums to project features and other elevation datasets. Data will be examined on a water year basis (October – September). Average water levels will be calculated by week, month, and/or yearly. These averages will be compared to the average marsh platform elevation. Also, depth and duration of flooding will be calculated by month and year.

5 Project-Level Decisions: Performance Criteria and Potential Correction Actions

The LA TIG describes how updated knowledge gained from the evaluation of monitoring data will be used at the project-level to determine whether the Project is considered successful or whether corrective actions are needed. A project may not be achieving its intended objectives because of previously identified key uncertainties, unanticipated consequences, previously unknown conditions, or unanticipated environmental drivers. The decision to implement (or not implement) corrective actions is one type of decision within the larger adaptive management decision-making framework.

Learning through monitoring allows for corrective actions to be made to achieve desired outcomes. Table 3 identifies performance criteria, monitoring parameters, and potential corrective actions that could be taken if the performance criteria are not met (as defined in NRDA regulations (15 CFR 990.55(b)(1)(vii)). This table should not be considered all encompassing; rather, it represents a listing of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-implementation and included in an operations and maintenance (O&M) plan. The decision of whether or not a corrective action should be implemented for the Project should consider the overall outcomes of the restoration project (i.e., looking at the combined evaluation of multiple performance criteria) in order to understand why project performance deviates from the predicted or anticipated outcome. Corrective action may not be taken in all cases based on such considerations. The knowledge gained from this process could also inform future restoration decisions such as the selection, design, and implementation of similar projects.

Table 3. List of Project Monitoring Parameters, Performance Criteria, and Potential Corrective Actions

Monitoring Parameter	Final Performance Criteria Used to Determine Project Success	Potential Corrective Action(s)
Spatial Extent	There will be at least 94%[1] of the area classified as habitats other than water, rip-rap, and/or structures	Planting of appropriate species and/or addition of sediments
Elevation	There will be at least 94%[1] of the area within the project boundary having an elevation greater than -1.5[2] feet NAVD88	Addition or regrading of sediments; Addition of sand fencing
Shoreline Position	Shoreline position should not exceed -16.4 ft. per year[3]	Addition of sediments

[1] Per the Draft Environmental Assessment (CEC 2019a) table 2-3, at YR 0 the project has 717.1 total acres of dune, supratidal, and subtidal habitat. At YR 20, the project has 541.2 acres of those same habitats remaining. The calculations for YR 5 constitutes about a 44 acre loss which equates to 94% of the area remaining.

[2] Per the Draft Environmental Assessment (CEC 2019a) table 2-3, the lower elevation of subtidal is defined as -1.5 feet NAVD88. Hence, any elevation below that would be classified as open water.

[3] Per Byrnes et al. (2018), shoreline rate of change between 2004 and 2012 for the West Grand Terre island is -16.4 feet per year.

6 Monitoring Schedule

The project monitoring schedule (Table 4) is separated by monitoring activities. Pre-execution monitoring will occur before any project construction activities occur, if applicable. Execution of monitoring will occur when the construction activities have been deemed complete. Performance monitoring will occur in the years following construction (YRs 0-5).

Table 4. Monitoring Schedule

Monitoring Parameters	Monitoring Time Frame						
	Pre-Execution Monitoring	Execution Monitoring (initial)	Post-Execution Monitoring (on-going)				
	Year -1	As-Built (Year 0)	Year 1	Year 2	Year 3	Year 4	Year 5
Vegetation Survey			X		X		X
Elevation Survey		X			X		X
Aerial Imagery Acquisition	X	X	O	O	X	O	X
Water Level[1]	X	X	X	X	X	X	X

Note: X are required data acquisitions; O are optional.

[1] not collected or funded by project

7 Data Management

7.1 Data Description

To the extent practicable, all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets will be drafted prior to conducting any project monitoring activities. Original hard copy datasheets and notebooks and photographs will be retained by the implementing Trustee.

Relevant project data that are handwritten on hard copy datasheets or notebooks will be transcribed (entered) into standard digital format. All field datasheets and notebook entries will be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data will have properly documented FGDC/ISO metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data were collected, quality assurance/quality control [QA/QC] procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format—can reference different documents).

7.2 Data Review and Clearance

Data will be reviewed for QA/QC in accordance with the *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* (DWH Natural Resource Damage Assessment Trustees. 2017), and any errors in transcription will be corrected. Implementing Trustees will verify and validate data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format and labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with implementing Trustee agency requirements.

After all identified errors are addressed, data are considered to be cleared. The implementing Trustee will give the other LA TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-implementing Trustees shall confirm with one another that the package is approved for submission.

7.3 Data Storage and Accessibility

Once data have been cleared, they will be submitted to the Restoration Portal. Trustees will provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible, and no more than 1 year from when data are collected.

7.4 Data Sharing

Data will be made publicly available in accordance with the Federal Open Data Policy through the DIVER Explorer Interface within 1 year of when the data collection occurred. Also, data will be made available through the Coastal Protection and Restoration Authority's Coastal Information Management System (CIMS) database (https://cims.coastal.louisiana.gov/default.aspx). Larger datasets such as LiDAR will be made available through portals appropriate for handling the associated file sizes.

8 Reporting

Based on the project monitoring schedule (Section 4), associated reporting will be submitted in post-construction YRs 2, 4, and 6 which represents one year after data collection efforts in YRs 1, 3, and 5. Each of these reports will primarily focus on answering the questions presented in Section 4, Evaluation.

The YR 1 and 3 reports will be progress reports. The YR 5 report will be a comprehensive report and answer whether or not the project met each of the performance criteria (PC). If the project did not meet a PC, then an explanation will be provided. For each report, if corrective actions are required then a corrective action plan would be generated and variables would continue to be monitored.

The reports will follow the template recommended in the most recent version of the *Monitoring and Adaptive Management Procedures and Guidelines Manual* which is currently *Version 1.0* (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017), Appendix D. MAM reports and lessons learned from the monitoring activities will be disseminated to the LA TIG through relevant portals, and information will be more broadly disseminated at conferences to reach a larger audience.

9 Roles and Responsibilities

The LA TIG is responsible for addressing MAM objectives that pertain to their restoration activities and for communicating information to the Trustee Council or Cross-LA TIG MAM work group. CPRA is the implementing Trustee for the project. The U.S. Environmental Protection Agency will be the lead federal agency for conducting the environmental evaluation review for implementation. The implementing Trustees' roles include:

- Data collection
- Data analysis
- Report composition
- Ensuring corrective action activities are performed, if necessary
- Providing project progress information to the LA TIG

10 Monitoring and Adaptive Management Budget

The overall budget for the project monitoring and adaptive management plan is $1,110,00 and covers the activities identified in Table 4 as well as data analysis, report composition, and project management.

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12 MAM Plan Revision History

Old Version #	Revision Date	Changes Made	Reason for Change	New Version #

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Monitoring and Adaptive Management Plan for *Deepwater Horizon* NRDA Project:

GOLDEN TRIANGLE MARSH CREATION PROJECT (PO-0163)

Prepared by: Todd Folse, Coastal Protection and Restoration Authority of Louisiana

Draft Version Date: 10/2/2019

Table of Contents

1 Introduction

The Deepwater Horizon (DWH) Louisiana Trustee Implementation Group (TIG)[1] developed this Monitoring and Adaptive Management (MAM) Plan (Plan) for the <u>Golden Triangle Marsh Creation Project</u> (Project) which was engineered and designed utilizing funds from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act). This Project will be constructed using funds associated with the Natural Resource Damage Assessment (NRDA). The purpose of this MAM Plan is to identify monitoring activities that will be conducted to evaluate and document restoration effectiveness, including performance criteria for determining restoration success or need for interim corrective action (15 CFR 990.55(b)(1)(vii)). Where applicable, the MAM Plan identifies key sources of project uncertainty and incorporates monitoring data and decision points that address these uncertainties to ensure that restoration objectives are met, and project benefits are maximized. It also establishes a decision-making process for making adjustments where needed.

There are three primary purposes for MAM Plans:

1. Identify and document how restoration managers will measure and track progress towards achieving restoration goals and objectives;
2. Increase the likelihood of successful implementation through identification, before a project begins, of potential corrective actions that could be undertaken if the project does not proceed as expected;
3. Ensure the capture, in a systematic way, of lessons learned or new information acquired that can be incorporated into future project selection, design, and implementation.

The MAM Plan is a living document and will be updated at the end of construction, just prior to the implementation of the monitoring activity in order to provide more specificity and to incorporate any changes that may have occurred during final engineering and design and/or construction. The MAM Plan may also be updated during the monitoring phase of the project, as needed, to reflect changing conditions and/or new information. For example, the MAM Plan may need to be revised should the project design change, if initial data analysis indicates that the sampling design requires adjustment, or if any uncertainties are resolved or new uncertainties are identified during project implementation and monitoring. Any future revisions to the MAM Plan will be made publicly available through the

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[1] The LA TIG includes the following members: Louisiana State Trustees include the Louisiana Coastal Protection and Restoration Authority (CPRA); Louisiana Department of Environmental Quality (LDEQ); Louisiana Department of Wildlife and Fisheries (LDWF); and Louisiana Department of Natural Resources (LDNR); Louisiana Oil Spill Coordinator's Office (LOSCO).Federal Trustees include Department of the Interior (DOI), the National Oceanic and Atmospheric Administration (NOAA), United States Environmental Protection Agency (USEPA), and United States Department of Agriculture (USDA).

Restoration Portal (https://www.diver.orr.noaa.gov/web/guest/home) and accessible through the Deepwater Horizon NRDA Trustees website (http://www.restoration.noaa.gov/dwh/storymap/).

1.1 Project Overview

The Golden Triangle Marsh Creation Project is located in Orleans Parish, Louisiana on the northwest side of Lake Borgne, south of the Gulf Intracoastal Waterway (GIWW), and east of the Inner Harbor Channel (INHC) surge barrier and the Mississippi River Gulf Outlet (MRGO) (**Figure 1**). The approximate coordinates of the center of the project area are X = 3,746,352.1, Y = 554,525.1 (North American Datum of 1983 Louisiana State Plane, South Zone, U.S. survey feet). The Project's selected alternative for construction features three (3) marsh creation cells totaling approximately 774 acres of degraded intertidal marsh and approximately 45,000 linear feet of containment dikes. The borrow area is located south of Chef Pass in the northeastern section of Lake Borgne. The constructed target marsh elevation is +2.5 feet NAVD88. This elevation was chosen in order to maximize the time that the marsh elevation is located in the intertidal range. Upon completion of the project, suitable native herbaceous vegetation is expected to naturally become established within the first few years. However, vegetative plantings on the marsh platform may occur if natural succession does not occur as anticipated. The project is currently in the engineering and design phase and a 95% Design Report has been drafted.

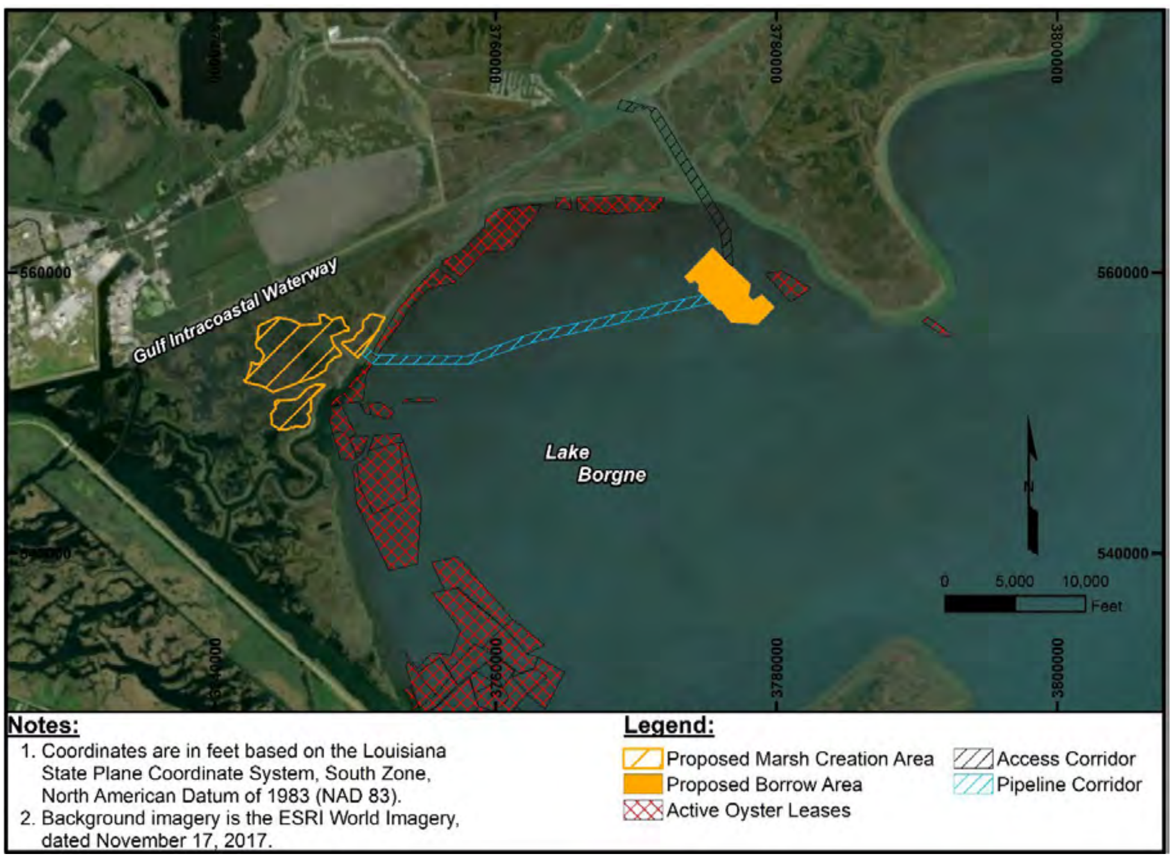

Figure 1. Project location map including the marsh restoration site, borrow area, and pipeline corridor (APTIM 2019).

The project is being implemented as restoration for the *Deepwater Horizon* oil spill (DWH oil spill) Natural Resource Damage Assessment (NRDA), consistent with the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS) (Deepwater Horizon Natural Resource Damage Assessment Trustees. 2016).

- **Programmatic Goal:** Restore and Conserve Habitat
- **Restoration Type:** Wetlands, Coastal, and Nearshore Habitats
- **Restoration Approach:** Create, Restore, and Enhance Coastal Wetlands
- **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material
- **Trustee Implementation Group:** Louisiana TIG
- **Restoration Plan:** Deepwater Horizon Oil Spill Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat

The implementing state trustee is the Coastal Protection and Restoration Authority (CPRA) of Louisiana. The lead federal trustee is the United States Department of Environmental Protection Agency.

1.2 Restoration Type Goals and Project Restoration Objectives

The goal for this Project is to create and restore wetlands, coastal and nearshore habitats in the Louisiana Restoration Area specifically in the area known as the Golden Triangle area within the Pontchartrain Basin. This area has been degraded due to eustatic sea-level rise, high subsidence rates, diminished sediment re-nourishment, and extreme storm events. In restoring these coastal habitats, the Trustees envision that the Project will compensate, in part, for wetlands, coastal and nearshore habitat losses associated with the DWH oil spill.

1.2.1 Restoration Type Goals

As summarized in the PDARP/PEIS, Chapter 5, the restoration goals for injuries to coastal habitats are as follows:

- Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- Restore habitats in appropriate combinations for any given geographic area.

1.2.2 Project Restoration Objectives

To help meet the restoration goals for injuries to coastal habitats, the project restoration objective is to create approximately 774 acres of new marsh habitat in the Golden Triangle area of the Pontchartrain Basin, which has been degraded due to sea-level rise, high subsidence rates, diminished sediment supply, and extreme storm events. The degree to which this restoration objective is met will be evaluated via measurements of the following parameters:

- Parameter #1: Spatial Extent (acres) of marsh creation

- Parameter #2: Elevation of marsh
- Parameter #3: Vegetative Cover
- Parameter #4: Invasive Species Cover

These parameters will be monitored according to the monitoring schedule summarized in Section 2.

Throughout the design process, project team members, including the CPRA, the National Oceanic and Atmospheric Administration (NOAA), and the USFWS will have the opportunity to refine design parameters as additional information becomes available. Performance criteria will be identified/implemented to determine restoration success or the need for corrective action in accordance with 15 CFR 990.55(b)(1)(vii)). Specific, measurable performance criteria are defined for monitoring parameters associated with each of the restoration objectives in Section 5.0.

1.3 Conceptual Setting

The Golden Triangle Project is located in Orleans Parish, Louisiana on the northwest side of Lake Borgne, south of the GIWW, and east of the INHC surge barrier and the MRGO. Historically, the marshes in this part of Louisiana received freshwater, nutrients and sediments from the Mississippi River through distributary channels and overbank flooding events. However, the Mississippi River levees have isolated these wetlands from these replenishing sediments; combined with coastal erosion and sea level rise, these factors have caused significant degradation of these marshes. Marsh creation projects like the one proposed here could help to build and maintain these habitats through time. Additional information about the conceptual setting for the Golden Triangle project is summarized in Section 3.2.2 of this RP/EA and is incorporated here by reference.

1.3.1 Potential Sources of Uncertainty

Although the likelihood of project success is evaluated under the OPA regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated (e.g., sediment compaction or vegetation success). For the Golden Triangle marsh creation project, the uncertainties summarized in **Table 1** could affect project success, and could therefore be key drivers of corrective actions or adaptive management decisions. Sections 2 through 3 summarize project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve stated project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to PDARP/PEIS Restoration Type MAM sections (Deepwater Horizon Natural Resource Damage Assessment Trustees. 2016), Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0 (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017), and other documents. Select monitoring activities can then be implemented to inform these uncertainties and to select appropriate corrective actions in the event the Project is not meeting its performance criteria (**Table 1**).

Table 1. Key Uncertainties

Reference Number	Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-making
1	Sea level rise and subsidence	Increased flooding of the marsh platform would reduce the growth and cover of herbaceous plant species and increase the coverage of submerged aquatic species or increase the open-water area.
2	Sediment compaction	Unpredicted compaction may lower the elevation of the marsh platform causing it to become subtidal earlier in the project life
3	Success of vegetation establishment/plantings	Lack of vegetation establishment/planting success would limit or delay the creation of the desired habitat.
4	Herbivory	Young tender plants, either through natural succession or vegetative plantings, are desired by some species as a source of food. Herbivory may cause the increase of planting efforts by requiring devices to reduce plant consumption. Also, would delay the establishment of vegetation and habitat creation.
5[1]	Impact on Gulf Sturgeon	Dredging will take place in Critical Habitat for Gulf Sturgeon. It is not known whether Gulf Sturgeon use these areas for foraging for benthic prey. Furthermore, it is not known whether borrow areas will alter water quality conditions relative to undisturbed areas or the long term impacts to substrate composition and/or benthic invertebrates.

[1] Data collected from the Lake Borgne Marsh Creation Project – Increment 1 project will assist in determining utilization of the borrow area by Gulf Sturgeon. Additional monitoring under this Plan may be implemented as a result of data collected from the Lake Borgne Marsh Creation Project – Increment 1 project.

2 Project Monitoring

The MAM Plan was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed, for the first 5 years after the project's construction. The data collected during this 5 year period will also be used to predict the project's performance during the remaining 15 years of the project's design life. For each of the identified monitoring parameters, information is provided as to their intended purpose (e.g., monitor progress toward meeting one or more of the restoration objectives, support adaptive management of the project, etc.), monitoring methods, timing and frequency, duration, sample size, and sites. Further, these parameters will be monitored to demonstrate how the restoration project is trending toward the performance criteria and to inform the need for corrective actions (see Section 5, Project-Level Decisions).

The *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017) recommends project-level monitoring be conducted at reference or control sites. The CPRA currently maintains a monitoring program that provides ecological data and research to support the planning, design, construction, evaluation, and adaptive management of Louisiana's wetland restoration projects (Folse et al. 2018).

This Coast-wide Reference Monitoring System-Wetlands (CRMS) was developed and implemented to improve the monitoring program's effectiveness in evaluating individual restoration projects, as well as the combined effects of multiple projects by providing a network of reference sites where data are collected on a regular basis (Steyer et al. 2003). There are seven (7) CRMS-Wetland sites: CRMS4107, CRMS3650, CRMS0002, CRMS3626, CRMS3641, CRMS3664, and CRMS3639, located between 2.5 and 10 miles of the Project which provide data since 2006. Vegetation and hydrologic data along with land/water analysis data from the CRMS program will be examined for comparative purposes inside and outside the project area in similar marsh habitats.

Though additional measures may be implemented to more fully characterize the Project's effectiveness, the LA TIG proposes the continued implementation of proven and established monitoring methodologies to monitor project success:

- Parameter #1: Spatial Extent (acres) of marsh creation
  a) Purpose(s): To determine how many acres met the marsh platform elevation at the end of construction criteria per the engineering and design requirements and how many acres of supratidal, intertidal, and subtidal marsh habitat developed/exist at years (YRs) 3 and 5 post-construction (APTIM 2019)
  b) Method(s): Acquire and orthorectify high-resolution, near-vertical aerial imagery; collect topographic survey data using Real-Time Kinematic (RTK) Global Positioning System (GPS) and/or Light Detection and Ranging (LiDAR) technology or an equivalent methodology
  c) Timing, Frequency, and Duration: YR 0 - immediate post-construction/as-built will occur soon after construction activities conclude; Years (YRs) 3 and 5 post-construction - will occur during the Fall of the respective years
  d) Sample Size: Aerial imagery will be acquired for the entire project area and some surrounding areas; RTK would be acquired over the entire project area using transect spacing of 500 feet for YRs 0 and 5 and 1,000 feet for YR 3, elevation will be collected approximately every 50 feet along the transect, transects will be the same for YRs 0 and 5 and every other for YR 3; LiDAR would cover the entire project area
  e) Sites: Slightly larger than project area

- Parameter #2: Elevation of marsh
  a) Purpose: To determine that the average elevation is achieved per the design specifications for construction and to verify the elevation of the sediment is as expected per the design curves in the final design report at YRs 3 and 5 post-construction.
  b) Method: LiDAR and/or RTK topographic surveys
  c) Timing, Frequency, and Duration: Surveys will be conducted during construction (before and after sediment placement) and at YRs 0, 3, and 5 post-construction.
  d) Sample Size: Construction surveys will be conducted on transects spaced every 250 feet apart or as specified in the construction documents. YR 0 would utilize LiDAR depending of vegetative cover and consolidation of sediments. RTK transects would be spaced 500 feet at

YRs 0 and 5 and 1,000 feet at YR 3. Elevation points would be collected approximately every 50 feet along the transect, transects would be the same for YRs 0 and 5 and every other for YR 3.

e) Sites: Slightly larger than project area

- Parameter #3: Vegetative Cover
  a) Purpose: To determine the vegetative percent cover in the marsh
  b) Method: Ocular estimates of percent cover of each species identified, height measurements of the dominant species, and percent cover of the carpet, herbaceous, shrub, and tree layers, if present, within a 2 meter by 2 meter plot (Folse et al. 2018) randomly placed along elevation transects throughout the project area.
  c) Timing, Frequency, and Duration: YR 1 – after first growing season (if sediment consolidation allows access), YRs 3 and 5 post-construction. Sampling will occur between mid-August and mid-November with the target being September/October.
  d) Sample Size: To be determined
  e) Sites: Project area; CRMS sites and restoration projects having similar habitats will be used as references

- Parameter #4: Invasive Species Cover
  a) Purpose: To determine invasive specie(s) percent cover
  b) Method: Ocular estimates of percent cover of each species identified, height measurements of the dominant species, and percent cover of the carpet, herbaceous, shrub, and tree layers, if present, within a 2 meter by 2 meter plot (Folse et al. 2018) randomly placed along transects through the project area; same plots as Parameter #3: Vegetative Cover
  c) Timing, Frequency, and Duration: Same as Parameter #3: Vegetative Cover
  d) Sample Size: To be determined
  e) Sites: Project area; CRMS sites and restoration projects having similar habitats will be used as references

3 Adaptive Management

Monitoring information collected at the project-level can be used to adaptively manage the project to improve restoration outcomes. Within the LA TIG, an adaptive management framework has been developed that identifies and characterizes the four main phases and is illustrated within a representative management cycle (**Figure 2**).

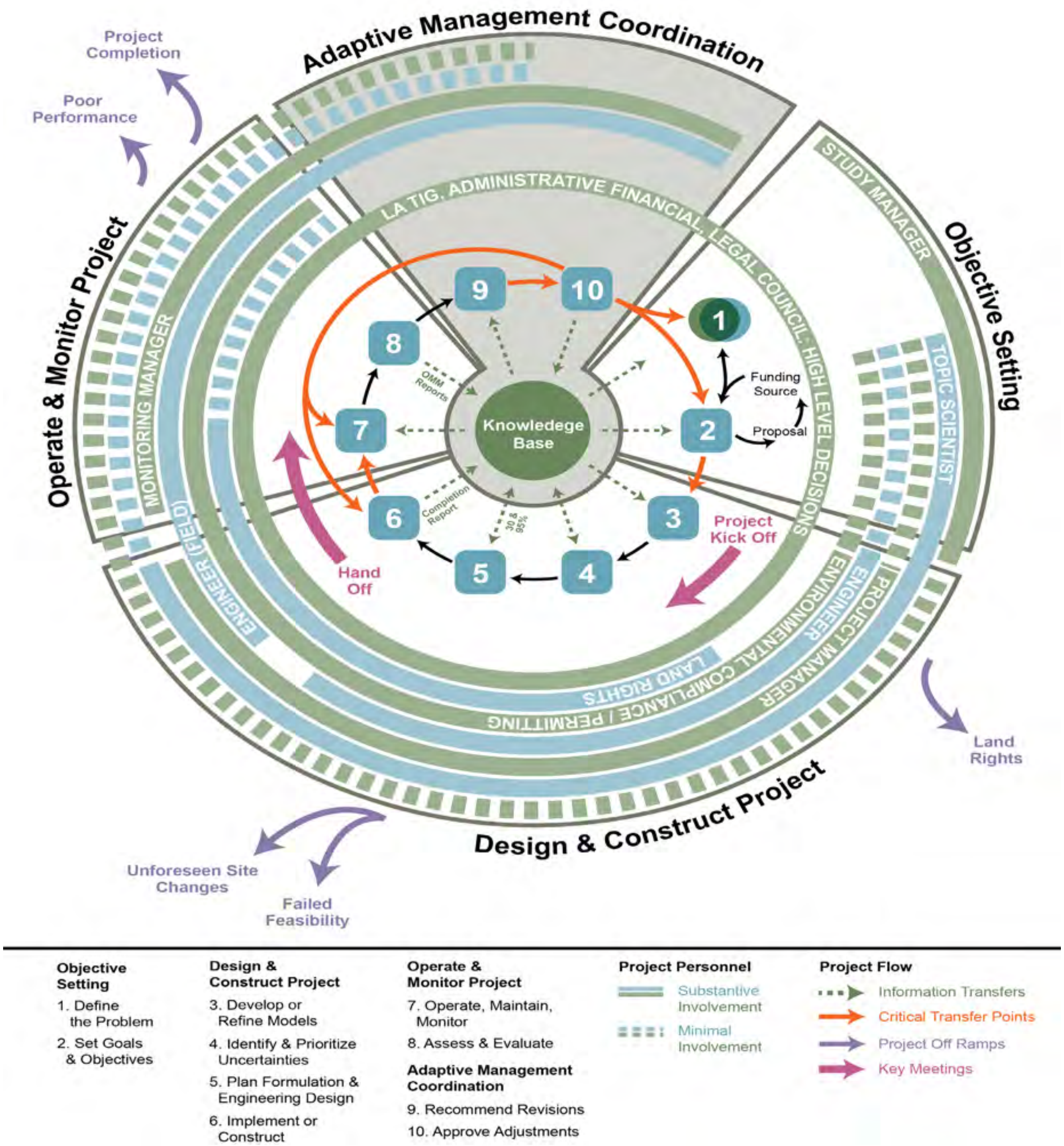

Figure 2. LA TIG Adaptive Management Cycle (*Source: The Water Institute of the Gulf. 2019*)

1. Objective-Setting Phase: Problem is identified or defined and project goals and objectives are established based on multiple sources, including lessons learned, data and associated synthesis, and applied research from previous projects and from the knowledge base as a whole. For the Golden Triangle Marsh Creation project, the goal setting phase is already complete – the problem of marsh loss has been defined through the PDARP/PEIS as well as through Louisiana's Coastal Master Plan process, and the goals and objectives of restoration are as described in the restoration plan that accompanies this MAM Plan.

2. Design and Construct Phase: Project advances through select steps, including model development or refinement, identification and prioritization of uncertainties, plan formulation, engineering, design, and project construction. For this project, the elements of a preliminary design have already been described within the Restoration Plan, incorporating available data on water depths, intertidal range for nearby marsh, and local subsidence rates. As the project advances to more advanced phases, the design may be modified as needed to incorporate any new information that could affect the preliminary design.
3. Operate and Monitor Phase: Project's operations, maintenance, and monitoring plans are developed and project assessment and evaluation criteria are identified. Note that for this and other marsh creation projects, the opportunities for adaptive management post-construction may in some cases be limited. For example, if the marsh platform does not achieve the proper elevation post-settlement, re-mobilizing a dredge to modify the marsh platform elevation is generally cost-prohibitive. However, supplemental vegetative plantings can be used to improve vegetative cover if the marsh platform is already at the proper elevation.
4. Adaptive Management Coordination Phase: Encompasses steps for recommending and approving project revisions so that revisions can achieve one or both of the following:

    - Result in alterations and redesign of project elements or changes to project operation
    - Provide input to either the understanding of the overall problem statements or the refinement of attainable or realistic goals and objectives for future projects

Where gaps in scientific understanding exist, project information collected (see Section 2, Project Monitoring) and evaluated (see Section 4, Evaluation) may be utilized by the LA TIG to reduce key uncertainties and/or other analyses that inform the selection, design, and optimization of future restoration projects (Framework).

4 Evaluation

Evaluation of monitoring data is needed to assess the project implementation and performance in meeting restoration objectives, resolving uncertainties to increase understanding, and determining whether corrective actions are needed.

As part of the larger decision-making context, the evaluation of monitoring data from individual projects could also be compiled and assessed at the restoration type and LA TIG level, and the results would be used to update the knowledge base to inform decisions such as future LA TIG project prioritization and selection, implementation techniques, and the identification of critical uncertainties. Reports, presentations, and/or lesson learned meetings are potential avenues of transferring information to the LATIG and other agency personnel about project performance.

The results of these analyses would be used to answer the following questions and included within the reports described in Section 8 of this plan:

- Were the project restoration objectives achieved? If not, is there a reason why they were not met?
- Did the restoration project produce unanticipated effects?

- Were there unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

Proposed analysis methods are grouped by monitoring parameters:

Parameter #1: Spatial Extent (acres) of marsh creation

Analysis: As-built (YR 0) aerial imagery and elevation data sets collected for the project will be used to determine the spatial extent of that which was constructed and if it met the construction requirements. Aerial imagery, elevation, and/or vegetation data sets collected in YRs 3 and 5 will be analyzed to determine marsh habitat development and evolution. Aerial imagery will be analyzed for land – water composition. Vegetation data will be used to determine habitat types and species composition of the land portion of the project. Elevation data will be used to determine the average depth of water and the average elevation of the land/marsh habitat.

Parameter #2: Elevation of marsh

Analysis: The project's Final Design Report will establish the desired elevation of each feature in order for appropriate herbaceous species to colonize and create marsh habitat. Data will be analyzed for the average elevation in each habitat. Other mapping products such as triangulated irregular network (TIN) models could be generated in Geographical Information System (GIS) software packages along with digital elevation models (DEM) to show the elevation across the project area. Over time, differences amongst the individual models would show elevation changes.

The constructed target elevations for marsh will be determined using the methodology(ies) in CPRA's Marsh Creation Design Guidelines (2017). These elevations use various data sources such as water elevation, sea-level rise, and subsidence. At YRs 3 and 5, data will be analyzed using the same methods and updated data (current water elevations and habitat elevations) to determine if the habitat is within the optimal marsh inundation ranges for habitat development. The same water level gauges used in the Final Design Report will be used for YRs 3 and 5, if still active.

The average elevation will be determined using YRs 3 and 5 data sets to determine if these elevations are as predicted in the project settlement curves that will be published in the Final Design Report.

Parameter #3: Vegetative Cover

Analysis: General descriptive statistical analyses may include, but are not limited to, averages/means of the overall total cover by herbaceous species and/or shrubs (marsh); percent cover of species; and/or average height of dominant/species. After each data collection effort, all collected and analyzed data will be evaluated to determine existing habitat type. After multiple data collection efforts, comparisons between each time period will be assessed to determine the evolution of the habitat. Data from CRMS sites in the vicinity, within the basin, and coast-wide of similar habitats may be analyzed for comparative performance purposes. Data from other marsh creation projects using borrow material from lakes and bays and in the same habitat type across Louisiana will be examined for performance comparisons.

Parameter #4: Invasive Species Cover

Analysis: Data sets will be examined for invasive species. If invasive species are identified within the data set, the average percent cover will be calculated.

5 Project-Level Decisions: Performance Criteria and Potential Correction Actions

The LA TIG describes how updated knowledge gained from the evaluation of monitoring data will be used at the project-level to determine whether the Project is considered successful or whether corrective actions are needed. A project may not be achieving its intended objectives because of previously identified key uncertainties, unanticipated consequences, previously unknown conditions, or unanticipated environmental drivers. The decision to implement (or not implement) corrective actions is one type of decision within the larger adaptive management decision-making framework.

Learning through monitoring allows for corrective actions to be made to achieve desired outcomes. **Table 2** identifies performance criteria, monitoring parameters, and potential corrective actions that could be taken if the performance criteria are not met (as defined in NRDA regulations (15 CFR 990.55(b)(1)(vii)). This table should not be considered all encompassing; rather, it represents a listing of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-implementation and included in an operations and maintenance (O&M) plan. The decision of whether or not a corrective action should be implemented for the Project should consider the overall outcomes of the restoration project (i.e., looking at the combined evaluation of multiple performance criteria) in order to understand why project performance deviates from the predicted or anticipated outcome. Corrective action may not be taken in all cases based on such considerations. The knowledge gained from this process could also inform future restoration decisions such as the selection, design, and implementation of similar projects.

Table 2. List of Project Monitoring Parameters, Performance Criteria, and Potential Corrective Actions

Monitoring Parameter	Final Performance Criteria Used to Determine Project Success	Potential Corrective Actions
Spatial Extent	There will be no more than the equivalent of 0.87% annual land loss rate between year 0 and 5 post-construction.[1]	Planting of appropriate species and/or addition of sediment
Elevation	The target elevations stated in the Final Design Report a the time of construction.[2]	Addition or regrading of sediments
Vegetative Cover	Average live vegetative cover is equal to or greater than 65% at Year 5	Planting of herbaceous species
Invasive Species Cover	Average live cover of invasive species is not greater than 25% at Year 5.	Mechanical removal or herbicide application

[1] The land loss rate of 0.87% was determined by comparing the aerial imagery from 1976 to 2017 of the project area (Source: Draft 95% Design Report for the Golden Triangle Marsh Creation Project by APTIM in March 2019).

[2] The project is currently gathering data to make the final determination. The Final Design Report is scheduled for late 2019.

6 Monitoring Schedule

The project monitoring schedule (**Table 3**) is separated by monitoring activities. Pre-execution monitoring will occur before any project construction activities occur, if applicable. Execution of monitoring will occur when the construction activities have been deemed complete. Performance monitoring will occur in the years following construction (YRs 0-5).

Table 3. Monitoring Schedule

Monitoring Parameters	Monitoring Time Frame						
	Pre-Execution Monitoring	Execution Monitoring (initial)	Post-Execution Monitoring (on-going)				
	Year -1	As-built (Year 0)	Year 1	Year 2	Year 3	Year 4	Year 5
Vegetation Survey			X		X		X
Elevation Survey		X			X		X
Aerial Imagery Acquisition	X	X	O	O	X	O	X

Note: X are required data acquisitions; O are optional.

7 Data Management

7.1 Data Description

To the extent practicable, all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets will be drafted prior to conducting any project monitoring activities. Original hard copy datasheets and notebooks and photographs will be retained by the implementing Trustee.

Relevant project data that are handwritten on hard copy datasheets or notebooks will be transcribed (entered) into standard digital format. All field datasheets and notebook entries will be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data will have properly documented FGDC/ISO metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data were collected, quality assurance/quality control [QA/QC] procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format—can reference different documents).

7.2 Data Review and Clearance

Data will be reviewed for QA/QC in accordance with the *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* (DWH Natural Resource Damage Assessment Trustees. 2017), and any errors in transcription will be corrected. Implementing Trustees will verify and validate data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format and labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with implementing Trustee agency requirements.

After all identified errors are addressed, data are considered to be cleared. The implementing Trustee will give the other LA TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-implementing Trustees shall confirm with one another that the package is approved for submission.

7.3 Data Storage and Accessibility

Once data have been cleared, they will be submitted to the Restoration Portal.

Trustees will provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

7.4 Data Sharing

Data will be made publicly available in accordance with the Federal Open Data Policy through the DIVER Explorer Interface within 1 year of when the data collection occurred. Also, data will be made available through the Coastal Protection and Restoration Authority's Coastal Information Management System (CIMS) database (https://cims.coastal.louisiana.gov/default.aspx). Larger datasets such as LiDAR will be made available through portals appropriate for handling the associated file sizes.

8 Reporting

Based on the project monitoring schedule (Section 6), associated reporting will be submitted in post-construction YRs 2, 4, and 6 which represents one year after data collection efforts in YRs 1, 3, and 5. Each of these reports will primarily focus on answering the questions presented in Section 4, Evaluation.

The YR 1 and 3 reports will be progress reports. The YR 5 report will be a comprehensive report and answer whether or not the project met each of the performance criteria (PC). If the project did not meet a PC, then an explanation will be provided. For each report, if corrective actions are required then a corrective action plan would be generated and variables would continue to be monitored.

The reports will follow the template recommended in the most recent version of the *Monitoring and Adaptive Management Procedures and Guidelines Manual* which is currently *Version 1.0* (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017), Appendix D. MAM reports and lessons learned from the monitoring activities will be disseminated to the LA TIG through relevant portals, and information will be more broadly disseminated at conferences to reach a larger audience.

9 Roles and Responsibilities

The LA TIG is responsible for addressing MAM objectives that pertain to their restoration activities and for communicating information to the Trustee Council or Cross-LA TIG MAM work group. CPRA is the implementing Trustee for the project. The U.S. Environmental Protection Agency will be the lead federal agency for conducting the environmental evaluation review for implementation. The implementing Trustees' roles include:

- Data collection
- Data analysis
- Report composition
- Ensuring corrective action activities are performed, if necessary
- Providing project progress information to the LA TIG

10 Monitoring and Adaptive Management Budget

The overall budget for the project monitoring and adaptive management plan is $950,000 and covers the activities identified in Table 3 as well as data analysis, report composition, and project management.

11 References

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12 MAM Plan Revision History

Old Version #	Revision Date	Changes Made	Reason for Change	New Version #

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Monitoring and Adaptive Management Plan for *Deepwater Horizon* NRDA Project:

BILOXI MARSH LIVING SHORELINE PROJECT (PO-0174)

Prepared by: Todd Folse, Coastal Protection and Restoration Authority of Louisiana

Draft Version Date: 10/31/2019

<u>Table of Contents</u>

1 Introduction

The Deepwater Horizon (DWH) Louisiana Trustee Implementation Group (TIG)[1] developed this Monitoring and Adaptive Management Plan (MAM Plan) for the Biloxi Marsh Living Shoreline Project (Project) which was engineered and designed utilizing funds from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act). This Project will be constructed using funds associated with the Natural Resource Damage Assessment (NRDA). The purpose of this MAM Plan is to identify monitoring activities that will be conducted to evaluate and document restoration effectiveness, including performance criteria for determining restoration success or need for interim corrective action (15 CFR 990.55(b)(1)(vii)). Where applicable, the MAM Plan identifies key sources of project uncertainty and incorporates monitoring data and decision points that address these uncertainties to ensure that restoration objectives are met, and project benefits are maximized. It also establishes a decision-making process for making adjustments where needed.

There are three primary purposes for MAM Plans:

1. Identify and document how restoration managers will measure and track progress towards achieving restoration goals and objectives;
2. Increase the likelihood of successful implementation through identification, before a project begins, of potential corrective actions that could be undertaken if the project does not proceed as expected;
3. Ensure the capture, in a systematic way, of lessons learned or new information acquired that can be incorporated into future project selection, design, and implementation.

The MAM Plan is a living document and will be updated at the end of construction just prior to the implementation of the monitoring activity in order to provide more specificity and to incorporate any changes that may have occurred during final engineering and design and/or construction. The MAM Plan may also be updated during the monitoring phase of the project as needed to reflect changing conditions and/or new information. For example, the MAM Plan may need to be revised should the project design change, if initial data analysis indicates that the sampling design requires adjustment, if any uncertainties are resolved, or new uncertainties are identified during project implementation and monitoring. Any future revisions to the MAM Plan will be made publicly available through the

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[1] The LA TIG includes the following members: : Louisiana State Trustees include the Louisiana Coastal Protection and Restoration Authority (CPRA); Louisiana Department of Environmental Quality (LDEQ); Louisiana Department of Wildlife and Fisheries (LDWF); and Louisiana Department of Natural Resources (LDNR); Louisiana Oil Spill Coordinator's Office (LOSCO).Federal Trustees include Department of the Interior (DOI), the National Oceanic and Atmospheric Administration (NOAA), United States Environmental Protection Agency (USEPA), and United States Department of Agriculture (USDA).

Restoration Portal (https://www.diver.orr.noaa.gov/web/guest/home) and accessible through the Deepwater Horizon NRDA Trustees website (http://www.restoration.noaa.gov/dwh/storymap/).

1.1 Project Overview

The Biloxi Marsh Living Shoreline Project is located on the coastal fringe marsh in St. Bernard Parish, Louisiana within Eloi Bay. The project area extends from Mosquito Blight Bay to the mouth of Bayou La Loutre near Lydia Point, to just west of Paulina Point (**Figure 1**). The project is anticipated to protect 11 miles of coastal fringe marsh shoreline. The project will be located adjacent to the Coastal Protection and Restoration Authority's (CPRA) Living Shoreline Demonstration (PO-0148) project and the Nature Conservancy's Lake Fortuna and Eloi Bay reefs.

Shoreline erosion by wind-driven wave action is the dominant cause of marsh loss in the project area. Because Breton Sound and Chandeleur Sound barrier islands are approximately 20 miles offshore, the barrier islands provide little protection to the estuary and fringe marsh where the project is located. These marshes function as an important storm buffer for the city of New Orleans and provide a variety of ecosystem services and important habitat for coastal species.

The project aims to create a living shoreline breakwater by placing a manufactured product, or suite of products, along the project shoreline. The bioengineered oyster reef breakwaters, which are man-made structures design to promote the formation of marsh fringe oyster reefs, will serve as an important line of defense for coastal marshes in the project area by preventing or reducing the rate of erosion along the project shoreline. It is anticipated that the project will promote self-sustaining living shoreline structures to protect approximately 11 miles of shoreline. The project will protect and restore nearshore habitat while providing oyster habitat, which plays a critical role in Louisiana's coastal ecosystem and economy. The project is currently in early engineering and design.

This project is being implemented as restoration for the *Deepwater Horizon* oil spill NRDA, consistent with the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS) (Deepwater Horizon [DWH] Natural Resource Damage Assessment Trustees 2016). Per the PDARP/PEIS, the proposed project falls into the following restoration categories:

- **Programmatic Goal:** Restore and Conserve Habitat
- **Restoration Type:** Wetlands, Coastal, and Nearshore Habitats
- **Restoration Approach:** Restore oyster reef habitat
- **Restoration Technique:**
- Restore oyster reef habitat by placing a manufactured product or products off the shoreline to establish a living breakwater structure
- **Trustee Implementation Group:** Louisiana TIG
- **Restoration Plan:** Deepwater Horizon Oil Spill Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitat (RP/EA #6).

The implementing state trustee is the CPRA of Louisiana. The lead federal trustee is the United States Environmental Protection Agency (EPA).

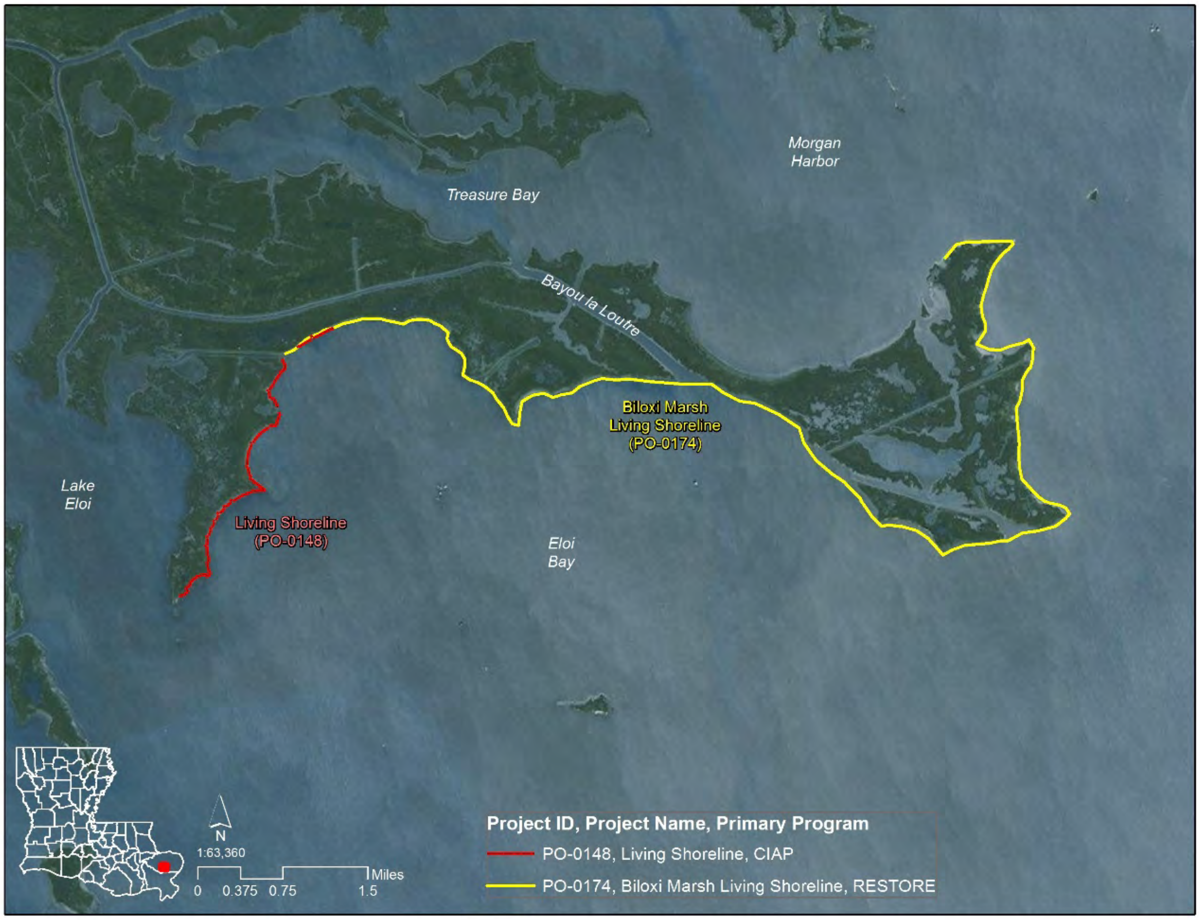

Figure 1. Project location map.

1.2 Restoration Type Goals and Project Restoration Objectives

The goal for this Project is to reduce shoreline recession and enhance local oyster production through implementation of marsh-fringing, bioengineered oyster reefs in the Louisiana Restoration Area specifically in Eloi Bay within the Pontchartrain Basin. This area has been degraded due to eustatic sea-level rise, high subsidence rates, wind-driven wave action, and extreme storm events. In restoring these coastal habitats, the Trustees envision that the Project will compensate, in part, for wetlands, coastal and nearshore habitat losses associated with the DWH Oil Spill.

1.2.1 Restoration Type Goals

As summarized in the PDARP/PEIS, Chapter 5, the restoration goals for injuries to coastal habitats are as follows (DWH Trustees 2016):

- Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf States to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill.

- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- Restore habitats in appropriate combinations for any given geographic area.

1.2.2 Project Restoration Objectives

To help meet the restoration goals for injuries to coastal habitats, the project restoration objective is to reduce shoreline recession and enhance local oyster production through implementation of marsh-fringing, bioengineered oyster reefs in Eloi Bay. The degree to which this restoration objective is met will be evaluated via measurements of the following parameters:

- Parameter #1: Shoreline Position
- Parameter #2: Elevation
- Parameter #3: Oyster Recruitment
- Parameter #4: Water Level and Salinity

These parameters will be monitored according to the monitoring schedule summarized in Section 2.

Throughout the design process, the LA TIG members will have the opportunity to refine design parameters as additional information becomes available. Performance criteria will be identified/implemented to determine restoration success or the need for corrective action in accordance with 15 CFR 990.55(b)(1)(vii)). Specific, measurable performance criteria are defined for monitoring parameters associated with each of the restoration objectives in Section 5.0.

1.3 Conceptual Setting

The Biloxi Marsh Living Shoreline project is located in St. Bernard Parish, Louisiana along the north shore of Bay Eloi. The primary factor of land loss in this area of the parish is erosion from wind-driven waves. The shoreline protection project would intercept the wind driven waves prior to the impact with the marsh shoreline in an effort to reduce the erosion capacity of the waves thereby reducing the rate of shoreline erosion and protecting the marsh over time. Additional information about the conceptual setting for the Biloxi Marsh Living Shoreline project is summarized in Section 3.2.3 of this RP/EA, and is incorporated here by reference.

1.3.1 Potential Sources of Uncertainty

Although the likelihood of project success is evaluated under the OPA regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. Potential uncertainties are defined as those that may affect the ability to achieve stated project restoration objective(s). These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated (e.g., sediment compaction or structure stability). For the project, the uncertainties summarized in **Table 1** could affect project success, and could therefore be key drivers of corrective actions or adaptive management decisions. Sections 2 through 3 summarize project monitoring data and describe how this information will be used to inform adaptive management to address these uncertainties.

To aid in the identification of uncertainties, the Trustees utilized a variety of sources, including but not limited to PDARP/PEIS Restoration Type MAM sections (DWH Natural Resource Damage Assessment Trustees 2016), Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0 (DWH Natural Resource Damage Assessment Trustees 2017), and other documents. Select monitoring activities can then be implemented to inform these uncertainties and to select appropriate corrective actions in the event the Project is not meeting its performance criteria.

Table 1. Key Uncertainties

Reference Number	Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
1	Sea-level rise and subsidence	Overtopping of the artificial reef structure(s) would make the structure(s) ineffective as a shoreline protection feature
2	Soil stability	Artificial reef structures requires the soils beneath them to remain stable in order for them to remain in a functioning position
3	Oyster recruitment	The structures ability to allow oysters to settle and grow will enable the structure to function as a living reef and shoreline protection feature
4	Structure stability	The structures ability to remain functional and stable overtime while being exposed to all environmental conditions such as, but not limited to, sun, water, waves, tropical activity, and temperature.

2 Project Monitoring

This MAM Plan was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed, for the first 10 years after the project's construction. The data collected during this 10 year period will also be used to predict the project's performance during the remaining 10 years of the project's design life. For each of the identified monitoring parameters, information is provided as to their intended purpose (e.g., monitor progress toward meeting one or more of the restoration objectives, support adaptive management of the project, etc.),), monitoring methods, timing and frequency, duration, sample size, and sites. Further, these parameters will be monitored to demonstrate how the restoration project is trending toward the performance criteria and to inform the need for corrective actions (see Section 5, Project-Level Decisions).

The *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* recommends project-level monitoring be conducted both the project site and at reference or control sites (DWH NRDA Trustees 2017).
Though additional measures may be implemented to more fully characterize the Project's effectiveness, the Louisiana Trustee Implementation Group (LA TIG) proposes the continued implementation of proven and established monitoring methodologies to monitor project success, as follows:

- Parameter #1: Shoreline Position

a) Purpose: To document the shoreline position throughout the project life in order to determine shoreline change rates and compare to pre-project rates and engineering and design calculations.
b) Method(s): Acquire and orthorectify high-resolution, near-vertical aerial imagery
c) Timing, Frequency, and Duration: High-resolution, near-vertical aerial imagery will be collected prior to construction activity, at the end of construction (as-built), and years 4 and 10 post-construction. Acquisition will occur in January/February when water levels are at the lowest to ensure shoreline and structure exposure.
d) Sample Size: Aerial imagery will be acquired for the entire project area and some surrounding areas.
e) Sites: Entire project area and areas adjacent to project area that have no structures.

- Parameter #2: Elevation
    a) Purpose: To determine elevation change bayward and shoreward of the artificial reef structure. To determine settlement of the structures.
    b) Method: RTK/drone topographic and bathymetric surveys
    c) Timing, Frequency, and Duration: Surveys will be collected in January-March of post-construction years 0, 4, and 10.
    f) Sample Size: RTK will be collected along 5 transects per 1,000 foot of artificial reef section. Transects will be located 50 and 200 feet from each end and the center of the section. Transects will be approximately 500 feet in length extending from about 200 feet on the marsh to 250 feet bayward of the structure. Elevations will also be captured at the base of the structure and several points on the structure. It is currently estimated that 50% of the structures will be surveyed.
    d) Sites: Project area and reference area

- Parameter #3: Oyster recruitment
    a) Purpose: To determine the artificial reefs ability to recruit and sustain the production of oysters through time
    b) Method: Quarter meter sampling during low water events in the winter months, measuring number of oysters, and other encrusting organisms, and recording oyster shell heights for all counted oysters.
    c) Timing, Frequency, and Duration: Annual sampling will occur during low water months of the year which is primarily December through February.
    d) Sample Size: To be determined; but tentatively, 9 fetches x 5 sample locations X 2 reef sides; this will be adjusted based on final reef placement, selection of products, etc. and may increase slightly.
    e) Sites: Project area

- Parameter #4: Water Level and Salinity
  a) Purpose: To calculate the water elevation as it relates to the structures to determine effectiveness of the structure as a shoreline protection feature and living reef structure. To monitor salinity concentrations in the vicinity of the structures since it is a key component for oyster survival.
  b) Method: Continuous recorder set for hour readings
  c) Timing, Frequency, and Duration: YRs 0 - 10
  d) Sample Size: One
  e) Sites: Project area

3 Adaptive Management

Monitoring information collected at the project-level can be used to adaptively manage the project to improve restoration outcomes. Within the LA TIG, an adaptive management framework has been developed that identifies and characterizes the four main phases and is illustrated within a representative management cycle (**Figure 2**).

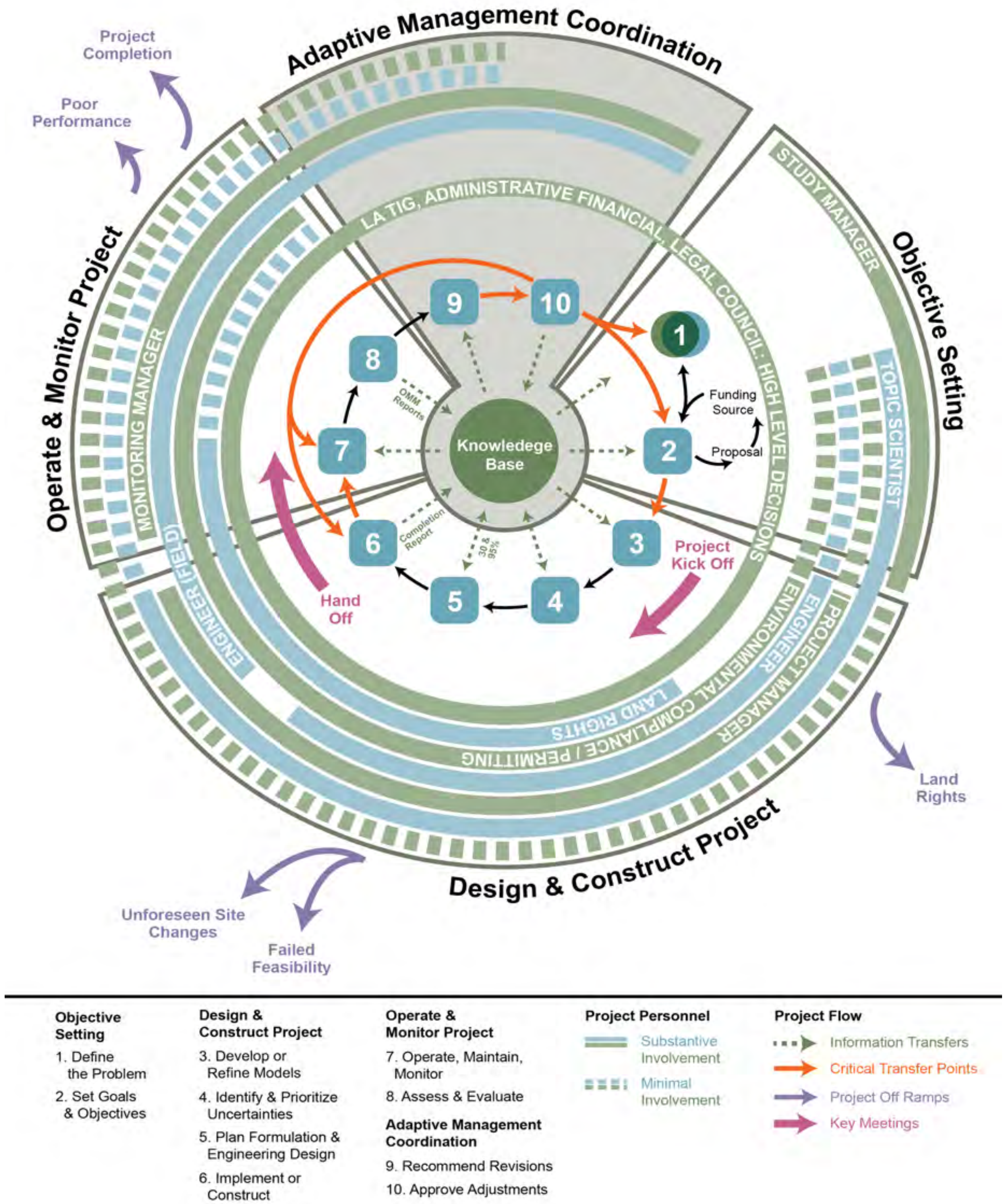

Figure 2. LA TIG Adaptive Management Cycle (*Source: The Water Institute of the Gulf 2019*)

1. Objective-Setting Phase: Problem is identified or defined and project goals and objectives are established based on multiple sources, including lessons learned, data and associated synthesis, and applied research from previous projects and from the knowledge base as a whole. For the Biloxi Marsh Living Shoreline Project, the goal setting phase is already complete – the problem of

marsh loss has been defined through the PDARP/PEIS as well as through Louisiana's Coastal Master Plan process, and the goals and objectives of restoration are as described in the restoration plan that accompanies this MAM plan.

2. Design and Construct Phase: Project advances through select steps, including model development or refinement, identification and prioritization of uncertainties, plan formulation, engineering, design, and project construction. For this project, the elements of a preliminary design have already been described within RP/EA #6, incorporating available data on water depths, intertidal range for nearby marsh, and local subsidence rates. As the project advances to more advanced phases, the design may be modified as needed to incorporate any new information that could affect the preliminary design.
3. Operate and Monitor Phase: Project's operations, maintenance, and monitoring plans are developed and project assessment and evaluation criteria are identified. Note that for this and other shoreline protection projects, the opportunities for adaptive management post-construction may in some cases be limited. For example, if the shoreline continues to retreat or marsh continues to subside, adjustments to the shoreline protection structures may be cost-prohibitive.
4. Adaptive Management Coordination Phase: Encompasses steps for recommending and approving project revisions so that revisions can achieve one or both of the following:

    - Result in alterations and redesign of project elements or changes to project operation.
    - Provide input to either the understanding of the overall problem statements or the refinement of attainable or realistic goals and objectives for future projects.

Where gaps in scientific understanding exist, project information collected (see Section 2, Project Monitoring) and evaluated (see Section 4, Evaluation) may be utilized by the LA TIG to reduce key uncertainties and/or other analyses that inform the selection, design, and optimization of future restoration projects (Framework).

4 Evaluation

Evaluation of monitoring data is needed to assess the project implementation and performance in meeting restoration objectives, resolving uncertainties to increase understanding, and determining whether corrective actions are needed.

As part of the larger decision-making context, the evaluation of monitoring data from individual projects could also be compiled and assessed at the restoration type and LA TIG level, and the results would be used to update the knowledge base to inform decisions such as future LA TIG project prioritization and selection, implementation techniques, and the identification of critical uncertainties. Reports, presentations, and/or lesson learned meetings are potential avenues of transferring information to the LATIG and other agency personnel about project performance.

The results of these analyses would be used to answer the following questions and included within the reports described in Section 8:

- Were the project restoration objectives achieved? If not, is there a reason why they were not met?
- Did the restoration project produce unanticipated effects?
- Were there unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

Proposed analysis methods are grouped by monitoring parameters:

Parameter #1: Shoreline Position

Analysis: All aerial imagery collected for this project or available through other sources will be used to digitize/map the existing shoreline. Comparisons between each or selected time periods will be performed. Calculations will be made to determine shoreline changes between the selected periods as well as change rates using the time each imagery was collected. Post-construction shoreline change rates will be compared to pre-construction shoreline change rates and engineering and design calculations to determine if the artificial reef structure(s) are performing as anticipated.

Parameter #2: Elevation

Analysis: All available elevation data associated with the project will be used to determine changes in the shoreline position as a supplement to the aerial imagery mapping effort. Elevation data collected along the same transects will be compared and analyzed for changes. Elevation data will graphically displayed as profile lines to visually observe the changes amongst the different time periods. Changes may be report as elevation changes shoreward and bayward of the artificial reef structure(s).

Parameter #3: Oyster recruitment

Analysis: Analyze oyster population demography and encrusting organisms in relation to available water quality (salinity, temperature, water level), location (leeward, windward), reef product (reef type) and reef “reach” as defined by orientation and fetch.

Parameter #4: Water Level and Salinity

Analysis: Hourly salinity will be analyzed to determine if the salinity regime in the project area is conducive for oyster growth throughout the year. Hourly water level data will be analyzed to determine the relationship between the water surface and the artificial breakwaters as well as the marsh surface.

5 Project-Level Decisions: Performance Criteria and Potential Correction Actions

The LA TIG describes how updated knowledge gained from the evaluation of monitoring data will be used at the project-level to determine whether the Project is considered successful or whether corrective actions are needed. A project may not be achieving its intended objectives because of previously identified key uncertainties, unanticipated consequences, previously unknown conditions, or unanticipated environmental drivers. The decision to implement (or not implement) corrective actions is one type of decision within the larger adaptive management decision-making framework.

Learning through monitoring allows for corrective actions to be made to achieve desired outcomes. Table 3 identifies performance criteria, monitoring parameters, and potential corrective actions that could be taken if the performance criteria are not met (as defined in NRDA regulations (15 CFR 990.55(b)(1)(vii)). This table should not be considered all encompassing; rather, it represents a listing of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-implementation and included in an operations and maintenance (O&M) plan. The decision of whether or not a corrective action should be implemented for the Project should consider the overall outcomes of the restoration project (i.e., looking at the combined evaluation of multiple performance criteria) in order to understand why project performance deviates from the predicted or anticipated outcome. Corrective action may not be taken in all cases based on such considerations. The knowledge gained from this process could also inform future restoration decisions such as the selection, design, and implementation of similar projects.

Table 3. List of Project Monitoring Parameters, Performance Criteria, and Potential Corrective Actions

Monitoring Parameter	Final Performance Criteria Used to Determine Project Success	Potential Corrective Action(s)
Shoreline Position	Post-construction shoreline erosion rates will not exceed pre-construction shoreline erosion rates	Evaluation of project effectiveness to determine applicability on other coastal shorelines in Louisiana
Elevation	NA[1]	
Oysters	NA[2]	
Water Level and Salinity	NA[3]	

[1] Elevation is being collected as ancillary data to inform how the environment immediately adjacent to the artificial reef structure(s) are changing.

[2] Oyster data is being collected as ancillary data to inform if the artificial reef structure(s) are acting as a substrate for the living reef.

[3] Water Level and Salinity is being collected as ancillary data to ensure the salinity regime is suitable for oyster growth.

6 Monitoring Schedule

The project monitoring schedule (Table 4) is separated by monitoring activities. Pre-execution monitoring will occur before any project construction activities occur, if applicable. Execution of monitoring will occur when the construction activities have been deemed complete. Performance monitoring will occur in the years following construction (YRs 0-10).

Table 4. Monitoring Schedule

Monitoring Parameters	Monitoring Time Frame											
	Pre-Execution Monitoring	Execution Monitoring (initial)	Post-Execution Monitoring (on-going)									
	YR -1	YR 0	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	YR 8	YR 9	YR 10
Oysters			X	X	X	X	X	X	X	X	X	X
Elevation			X			X						X
Aerial Imagery	X	X	O	O	O	X	O	O	O	O	O	X
Water Level and Salinity		X	X	X	X	X	X	X	X	X	X	X

Note: X are required data acquisitions; O are optional.

7 Data Management

7.1 Data Description

To the extent practicable, all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets will be drafted prior to conducting any project monitoring activities. Original hard copy datasheets and notebooks and photographs will be retained by the implementing Trustee.

Relevant project data that are handwritten on hard copy datasheets or notebooks will be transcribed (entered) into standard digital format. All field datasheets and notebook entries will be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data will have properly documented FGDC/ISO metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data were collected, quality assurance/quality control [QA/QC] procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format—can reference different documents).

7.2 Data Review and Clearance

Data will be reviewed for QA/QC in accordance with the *Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0* (DWH Natural Resource Damage Assessment Trustees 2017), and any errors in transcription will be corrected. Implementing Trustees will verify and validate data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format and labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with implementing Trustee agency requirements.

After all identified errors are addressed, data are considered to be cleared. The implementing Trustee will give the other LA TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-implementing Trustees shall confirm with one another that the package is approved for submission.

7.3 Data Storage and Accessibility

Once data have been cleared, they will be submitted to the Restoration Portal. Trustees will provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

7.4 Data Sharing

Data will be made publicly available in accordance with the Federal Open Data Policy through the DIVER Explorer Interface within 1 year of when the data collection occurred. Also, data will be made available through the Coastal Protection and Restoration Authority's Coastal Information Management System (CIMS) database (https://cims.coastal.louisiana.gov/default.aspx). Larger datasets such as LiDAR will be made available through portals appropriate for handling the associated file sizes.

8 Reporting

Based on the project monitoring schedule (Section 4), associated reporting will be submitted in post-construction YRs 1, 5, and 11. Each of these reports will primarily focus on answering the questions presented in Section 4, Evaluation.

The YRs 1, and 5 reports will be progress reports. The YR 11 report will be a comprehensive report and answer whether or not the project met each of the performance criteria (PC). If the project did not meet a PC, then an explanation will be provided. For each report, if corrective actions are required then a corrective action plan would be generated and variables would continue to be monitored.

The reports will follow the template recommended in the most recent version of the *Monitoring and Adaptive Management Procedures and Guidelines Manual* which is currently *Version 1.0* (*Deepwater Horizon* (DWH) Natural Resource Damage Assessment Trustees. 2017), Appendix D. MAM reports and lessons learned from the monitoring activities will be disseminated to the LA TIG through relevant portals, and information will be more broadly disseminated at conferences to reach a larger audience.

9 Roles and Responsibilities

The LA TIG is responsible for addressing MAM objectives that pertain to their restoration activities and for communicating information to the Trustee Council or Cross-LA TIG MAM work group. CPRA is the implementing Trustee for the project. The EPA will be the lead federal agency for conducting the environmental evaluation review for implementation. The implementing Trustees' roles include:

- Data collection
- Data analysis
- Report composition
- Ensuring corrective action activities are performed, if necessary
- Providing project progress information to the LA TIG

10 Monitoring and Adaptive Management Budget

The overall budget for the project monitoring and adaptive management plan is $1,987,650 and covers the activities identified in Table 4 as well as data analysis, report composition, and project management.

11 References

Deepwater Horizon (DWH) Natural Resource Damage Assessment Trustees. 2016. Deepwater Horizon oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. Retrieved from http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

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12 MAM Plan Revision History

Old Version #	Revision Date	Changes Made	Reason for Change	New Version #

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APPENDIX E

Guidelines for National Environmental Policy Act Impact Determinations in the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*

Table 6.3-2. Guidelines for NEPA impact determinations in the Final PDARP/PEIS.

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
Physical Resources				
Geology and Substrates	Short-term: During construction period. Long-term: Over the life of the project or longer.	Disturbance to geologic features or soils could be detectable, but could be small and localized. There could be no changes to local geologic features or soil characteristics. Erosion and/or compaction could occur in localized areas.	Disturbance could occur over local and immediately adjacent areas. Impacts to geology or soils could be readily apparent and result in changes to the soil character or local geologic characteristics. Erosion and compaction impacts could occur over local and immediately adjacent areas.	Disturbance could occur over a widespread area. Impacts to geology or soils could be readily apparent and could result in changes to the character of the geology or soils over a widespread area. Erosion and compaction could occur over a widespread area. Disruptions to substrates or soils may be permanent.
Hydrology and Water Quality	Short-term: During construction period. Long-term: Over the life of the project or longer.	Hydrology: The effect on hydrology could be measurable, but it could be small and localized. The effect could only temporarily alter the area's hydrology, including surface and ground water flows. Water quality: Impacts could result in a detectable change to water quality, but the change could be expected to be small and localized. Impacts could quickly become undetectable. State water quality standards as required by the Clean Water Act could not be exceeded. Floodplains: Impacts may result in a detectable change to natural and beneficial floodplain values, but the change could be expected to be small, and localized. There could be no appreciable increased risk of flood loss including impacts on human safety, health, and welfare. Wetlands: The effect on wetlands could be measurable but small in terms of area and the nature of the impact. A small impact on the size, integrity, or	Hydrology: The effect on hydrology could be measurable, but small and limited to local and adjacent areas. The effect could permanently alter the area's hydrology, including surface and ground water flows. Water quality: Effects to water quality could be observable over a relatively large area. Impacts could result in a change to water quality that could be readily detectable and limited to local and adjacent areas. Change in water quality could persist; however, it could likely not exceed state water quality standards as required by the Clean Water Act. Floodplains: Impacts could result in a change to natural and beneficial floodplain values and could be readily detectable, but limited to local and adjacent areas. Location of operations in floodplains could increase risk of flood loss, including impacts on human safety, health, and welfare.	Hydrology: The effect on hydrology could be measurable and widespread. The effect could permanently alter hydrologic patterns including surface and ground water flows. Water quality: Impacts could likely result in a change to water quality that could be readily detectable and widespread. Impacts could likely result in exceedance of state water quality standards and/or could impair designated uses of a water body. Floodplains: Impacts could result in a change to natural and beneficial floodplain values that could have substantial consequences over a widespread area. Location of operations could increase risk of flood loss, including impacts on human safety, health, and welfare. Wetlands: The action could cause a permanent loss of wetlands across a widespread area. The character of the wetlands could be changed so that the functions typically provided by the wetland could be permanently lost.

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
		connectivity could occur; however, wetland function could not be affected and natural restoration could occur if left alone.	Wetlands: The action could cause a measurable effect on wetlands indicators (size, integrity, or connectivity) or could result in a permanent loss of wetland acreage across local and adjacent areas. However, wetland functions could only be permanently altered in limited areas.	
Air Quality	Short-term: During construction period. Long-term: Over the life of the project or longer.	The impact on air quality may be measurable, but could be localized and temporary, such that the emissions do not exceed the Environmental Protection Agency's (EPA's) *de minimis* criteria for a general conformity determination under the Clean Air Act (40 CFR § 93.153).	The impact on air quality could be measurable and limited to local and adjacent areas. Emissions of criteria pollutants could be at EPA's *de minimis* criteria levels for general conformity determination.	The impact on air quality could be measurable over a widespread area. Emissions are high, such that they could exceed EPA's *de minimis* criteria for a general conformity determination.
Noise	Short-term: During construction period. Long-term: Over the life of the project.	Increased noise could attract attention, but its contribution to the soundscape would be localized and unlikely to affect current user activities.	Increased noise could attract attention and contribute to the soundscape including in local areas and those adjacent to the action, but could not dominate. User activities could be affected.	Increased noise could attract attention and dominate the soundscape over widespread areas. Noise levels could eliminate or discourage user activities.
Biological Resources				
Habitats	Short-term: Lasting less than two growing seasons. Long-term: Lasting longer than two growing seasons.	Impacts on native vegetation may be detectable, but could not alter natural conditions and could be limited to localized areas. Infrequent disturbance to individual plants could be expected, but would not affect local or range-wide population stability. Infrequent or insignificant one-time disturbance to locally suitable habitat could occur, but sufficient habitat could remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non-native species could be detectable but	Impacts on native vegetation could be measureable but limited to local and adjacent areas. Occasional disturbance to individual plants could be expected. These disturbances could affect local populations negatively but could not be expected to affect regional population stability. Some impacts might occur in key habitats, but sufficient local habitat could retain function to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native species could be detectable and	Impacts on native vegetation could be measurable and widespread. Frequent disturbances of individual plants could be expected, with negative impacts to both local and regional population levels. These disturbances could negatively affect range-wide population stability. Some impacts might occur in key habitats, and habitat impacts could negatively affect the viability of the species both locally and throughout its range. Actions could result in the widespread increase of non-native species, resulting in broad and permanent changes to native

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
		temporary and localized and could not displace native species populations and distributions.	limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	species populations and distributions.
Wildlife Species (Including Birds)	Short-term: Lasting up to two breeding seasons, depending on length of breeding season. Long-term: Lasting more than two breeding seasons.	Impacts to native species, their habitats, or the natural processes sustaining them could be detectable, but localized, and could not measurably alter natural conditions. Infrequent responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, resting, migrating, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors could occur. Sufficient habitat could remain functional at both the local and range-wide scales to maintain the viability of the species. Opportunity for increased spread of non-native species could be detectable but temporary and localized, and these species could not displace native species populations and distributions.	Impacts on native species, their habitats, or the natural processes sustaining them could be measureable but limited to local and adjacent areas. Occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat could retain function to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	Impacts on native species, their habitats, or the natural processes sustaining them could be detectable and widespread. Frequent responses to disturbance by some individuals could be expected, with negative impacts to feeding, reproduction, migrating, or other factors resulting in a decrease in both local and range-wide population levels and habitat type. Impacts could occur during critical periods of reproduction or in key habitats and could result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large changes or declines. Actions could result in the widespread increase of non-native species resulting in broad and permanent changes to native species populations and distributions.
Marine and Estuarine Fauna (Fish, Shellfish, Benthic Organisms)	Short-term: Lasting up to two spawning seasons, depending on length of season. Long-term: Lasting more than two spawning seasons.	Impacts could be detectable and localized but small. Disturbance of individual species could occur; however, there could be no change in the diversity or local populations of marine and estuarine species. Any disturbance could not interfere with key behaviors such as feeding and spawning. There could be no restriction of movements daily or seasonally. Opportunity for increased spread of non-native species could be detectable but	Impacts could be readily apparent and result in a change in marine and estuarine species populations in local and adjacent areas. Areas being disturbed may display a change in species diversity; however, overall populations could not be altered. Some key behaviors could be affected but not to the extent that species viability is affected. Some movements could be restricted seasonally. Opportunity for increased spread of non-	Impacts could be readily apparent and could substantially change marine and estuarine species populations over a wide-scale area, possibly river-basin-wide. Disturbances could result in a decrease in fish species diversity and populations. The viability of some species could be affected. Species movements could be seasonally constrained or eliminated. Actions could result in the widespread increase of non-native species resulting in broad and permanent changes to native

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
		temporary and localized and these species could not displace native species populations and distributions.	native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	species populations and distributions.
Protected Species	Short-term: Lasting up to one breeding/growing season. Long-term: Lasting more than one breeding/growing season.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, but small and localized, and could not measurably alter natural conditions. Impacts could likely result in a "may affect, not likely to adversely affect" determination for at least one listed species.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable and some alteration in the numbers of protected species or occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local and adjacent population levels. Impacts could occur in key habitats, but sufficient population numbers or habitat could remain functional to maintain the viability of the species both locally and throughout their range. Some disturbance to individuals or impacts to potential or designated critical habitat could occur. Impacts could likely result in a "may affect, likely to adversely affect" determination for at least one listed species. No adverse modification of critical habitat could be expected.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, widespread, and permanent. Substantial impacts to the population numbers of protected species, or interference with their survival, growth, or reproduction could be expected. There could be impacts to key habitat, resulting in substantial reductions in species numbers. Results in an "is likely to jeopardize proposed or listed species/adversely modify proposed or designated critical habitat (impairment)" determination for at least one listed species.

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
Socioeconomic Resources				
Socioeconomics and Environmental Justice[a]	Short-term: During construction period. Long-term: Over the life of the project or longer.	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions. Actions could not disproportionately affect minority and low-income populations.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions. Actions could disproportionately affect minority and low-income populations. However, the impact could be temporary and localized.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily detectable and observed, extend over a widespread area, and have a substantial influence on social and/or economic conditions. Actions could disproportionately affect minority and low-income populations, and this impact could be permanent and widespread.
Cultural Resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	The disturbance of a site(s), building, structure, or object could be confined to a small area with little, if any, loss of important cultural information potential.	Disturbance of a site(s), building, structure, or object not expected to result in a substantial loss of important cultural information.	Disturbance of a site(s), building, structure, or object could be substantial and may result in the loss of most or all its potential to yield important cultural information.
Infrastructure	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could affect public services or utilities but the impact could be localized and within operational capacities. There could be negligible increases in local daily traffic volumes resulting in perceived inconvenience to drivers but no actual disruptions to traffic.	The action could affect public services or utilities in local and adjacent areas and the impact could require the acquisition of additional service providers or capacity. Detectable increase in daily traffic volumes (with slightly reduced speed of travel), resulting in slowed traffic and delays, but no change in level of service (LOS). Short service interruptions (temporary closure for a few hours) to roadway and railroad traffic could occur.	The action could affect public services or utilities over a widespread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily traffic volumes (with reduced speed of travel) resulting in an adverse change in LOS to worsened conditions. Extensive service disruptions (temporary closure of one day or more) to roadways or railroad traffic could occur.
Land and Marine Management	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could require a variance or zoning change or an amendment to a land use, area comprehensive, or management plan, but could not affect overall use and management beyond the local area.	The action could require a variance or zoning change or an amendment to a land use, area comprehensive, or management plan, and could affect overall land use and management in local and adjacent areas.	The action could cause permanent changes to and conflict with land uses or management plans over a widespread area.

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
Tourism and Recreational Use	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be partial developed recreational site closures to protect public safety. The same site capacity and visitor experience could remain unchanged after construction. The impact could be detectable and/or could only affect some recreationists. Users could likely be aware of the action but changes in use could be slight. There could be partial closures to protect public safety. Impacts could be local. There could be a change in local recreational opportunities; however, it could affect relatively few visitors or could not affect any related recreational activities.	There could be complete site closures to protect public safety. However, the sites could be reopened after activities occur. There could be slightly reduced site capacity. The visitor experience could be slightly changed but still available. The impact could be readily apparent and/or could affect many recreationists locally and in adjacent areas. Users could be aware of the action. There could be complete closures to protect public safety. However, the areas could be reopened after activities occur. Some users could choose to pursue activities in other available local or regional areas.	All developed site capacity could be eliminated because developed facilities could be closed and removed. Visitors could be displaced to facilities over a widespread area and visitor experiences could no longer be available in many locations. The impact could affect most recreationists over a widespread area. Users could be highly aware of the action. Users could choose to pursue activities in other available regional areas.
Fisheries and Aquaculture	Short-term: During construction period. Long-term: Over the life of the project or longer.	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily detectable and observed, extend over a widespread area, and could have a substantial influence on social and/or economic conditions.
Marine Transporta-tion	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could affect public services or utilities, but the impact could be localized and within operational capacities. There could be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to transportation.	The action could affect public services or utilities in local and adjacent areas, and the impact could require the acquisition of additional service providers or capacity. Detectable increase in daily marine traffic volumes could occur (with slightly reduced speed of travel), resulting in slowed traffic and delays. Short service interruptions could occur (temporary delays for a few hours).	The action could affect public services utilities over a widespread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily marine traffic volumes could occur (with reduced speed of travel), resulting in extensive service disruptions (temporary closure of one day or more).

Resource	Impact Duration	Impact Intensity Definitions		
		Minor	Moderate	Major
Aesthetics and Visual Resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be a change in the view shed that was readily apparent but could not attract attention, dominate the view, or detract from current user activities or experiences.	There could be a change in the view shed that was readily apparent and attracts attention. Changes could not dominate the viewscape, although they could detract from the current user activities or experiences.	Changes to the characteristic views could dominate and detract from current user activities or experiences.
Public Health and Safety, Including Flood and Shoreline Protection	Short-term: During construction period. Long-term: Over the life of the project or longer.	Actions could not result in 1) soil, ground water, and/or surface water contamination; 2) exposure of contaminated media to construction workers or transmission line operations personnel; and/or 3) mobilization and migration of contaminants currently in the soil, ground water, or surface water at levels that could harm the workers or general public. Increased risk of potential hazards (e.g., increased likelihood of storm surge) to visitors, residents, and workers from decreased shoreline integrity could be temporary and localized.	Project construction and operation could result in 1) exposure, mobilization and/or migration of existing contaminated soil, ground water, or surface water to an extent that requires mitigation; and/or 2) could introduce detectable levels of contaminants to soil, ground water, and/or surface water in localized areas within the project boundaries such that mitigation/remediation is required to restore the affected area to the preconstruction conditions. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be sufficient to cause a permanent change in use patterns and area avoidance in local and adjacent areas.	Actions could result in 1) soil, ground water, and/or surface water contamination at levels exceeding federal, state, or local hazardous waste criteria, including those established by 40 CFR § 261; 2) mobilization of contaminants currently in the soil, ground water, or surface water, resulting in exposure of humans or other sensitive receptors such as plants and wildlife to contaminant levels that could result in health effects; and 3) the presence of contaminated soil, ground water, or surface water within the project area, exposing workers and/or the public to contaminated or hazardous materials at levels exceeding those permitted by the federal Occupational Safety and Health Administration (OSHA) in 29 CFR § 1910. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be substantial and could cause permanent changes in use patterns and area avoidance over a widespread area.

[a] Evaluation of potential environmental justice issues will be fully address in future tiered documents.

APPENDIX F

Cumulative Action Scenario

CUMULATIVE ACTION SCENARIO

F.1 Introduction

This cumulative action scenario describes the past, present, and reasonably foreseeable future actions, or projects, that were reviewed and evaluated for potential contributions to cumulative impacts (also referred to as effects) as part of the draft restoration plan/environmental assessment (RP/EA), *Louisiana Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #6: Restoration and Conserve Wetlands, Coastal, and Nearshore Habitat*. The projects included in the cumulative action scenario fall within the spatial and temporal boundaries established for the analysis, or the cumulative impacts analysis area (CIAA), which is a 1-mile buffered spatial area around each alternative presented in the RP/EA. Based on available information for each of the actions in the cumulative scenario, resource impacts and benefits that could result from construction and implementation of these projects were evaluated.

F.2 Methods for Identifying Cumulative Action Scenarios

The following sources were used to gather past, present, and reasonably foreseeable future projects within the Louisiana Gulf Coast region that fall within the CIAA of each alternative in the RP/EA. CIAAs for each alternative are presented in Figure F-1.

- Alternatives analyzed and existing infrastructure mentioned or analyzed in prior RP/EAs:
    - *Louisiana Trustee Implementation Group Final Restoration Plan #1: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; and Birds* (Louisiana Trustee Implementation Group [LA TIG] 2017)
    - *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities* (LA TIG 2018a)
    - *Louisiana Trustee Implementation Group Final Strategic Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in the Barataria Basin, Louisiana* (LA TIG 2018b)
    - *Louisiana Trustee Implementation Group Final Restoration Plan and Environmental Assessment #4: Nutrient Reduction (Nonpoint Source) and Recreational Use* (LA TIG 2018c)
- Bureau of Ocean Energy Management's (BOEM's) Marine Minerals Information System (BOEM 2019)
- Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Managing Agencies' Projects (CWPPRA 2019a)
- *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (Louisiana Coastal Protection and Restoration Authority [CPRA] 2017a)[1]
- Louisiana Department of Natural Resource's (LDNR's) Strategic Online Natural Resources Information System (SONRIS) (LDNR 2019)
- National Oceanic and Atmospheric Administration's (NOAA) Gulf Spill Restoration project portal (NOAA 2019)

[1] Some projects presented in *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA 2017a) were selected as alternatives that were analyzed in prior RP/EAs (LA TIG 2017, 2018a, 2018b, 2018c).

- Southeast Louisiana Flood Protection Authority's Hurricane and Storm Damage Risk Reduction System (HSDRRS) (Southeast Louisiana Flood Protection Authority – East 2017).
- U.S. Army Corps of Engineers (USACE) New Orleans District's Project Lists (USACE 2019a)
- U.S. Department of Transportation's (UDOT's) National Pipeline Mapping System (UDOT 2019)

Once projects from these sources were gathered, their locations were identified using project descriptions and geographic information system datasets, where available. These projects were mapped to identify those located within the CIAA of any alternative or those that had a defined area of impacts that would overlap the CIAA of any alternative. Projects that met these criteria are presented by alternative in Figures F-2–F-5.

Additional information was gathered from the above sources for projects within the CIAA including project types, project description, and status/timing. These details were used to identify impacts from construction and implementation of each project, and therefore, potential contributions to cumulative effects when considered in combination with impacts from each of the alternatives analyzed in the RP/EA. These project details are summarized in Table F-1.

For purposes of this appendix, projects are grouped consistent with the categories, or project types, considered in the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS) (Deepwater Horizon [DWH] Oil Spill Trustees 2016) and subsequent RP/EAs. These categories include 1) coastal restoration and improvements, 2) marine mineral mining, 3) dredged material disposal, 4) energy activities, and 5) tourism and recreation. A sixth category, Other, was added to capture other infrastructure that do not fall within the five Final PDARP/PEIS categories. There are no marine mineral mining or dredged material disposal projects within the CIAA for any alternative, and these categories have therefore been excluded from Table F-1.

Table F-1. Cumulative Action Scenario by Project Type

Project Name/Source	Location	Description	Status/Timing	Potential Impacted Resources	Applicable Alternative(s)*
Coastal Restoration and Improvements					
Barataria Barrier Island Complex: Pelican Island and Pass La Mer to Chaland Pass Restoration (CWPPRA 2019a)	Plaquemines Parish	National Marine Fisheries Service (NMFS) barrier island restoration project located along two sections of the Barataria Bay Shoreline in Plaquemines Parish. The Chaland Headland segment is about 3.1 miles long and is located between Pass La Mer and Chaland Pass. Pelican Island is located immediately east of the Empire Waterway; this segment was restored to maintain the integrity of 2.4 miles of shoreline.	Completed. The Chaland Headland portion of the project was completed in 2007. The Pelican Island portion of the project was completed in December 2012.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	WGT
Barataria Basin Black Mangrove Restoration (NOAA 2019)	Fifi Island	Project included the plantings of 2,100 black mangroves and 3,000 plugs of marsh grass on Fifi Island.	Complete	Geology and substrates, hydrology and water quality, noise	FI
Barrier Island Comprehensive Monitoring (BICM) (Byrnes et al. 2017, USGS 2019)[†]	Coast-wide and the shores of Lakes Pontchartrain and Lake Bogne	Program developed in 2005 by the LDNR, and implemented by LDNR, University of New Orleans-Pontchartrain Institute for Environmental Sciences (UNO-PIES), and the U.S. Geological Survey (USGS) as a framework for a coast-wide monitoring effort.	Not constructed	None	WGT, GT, BM, FI
Barrier Island Restoration Project: Renourishment Program (BIRP) (CPRA 2017b)[†]	Plaquemines and Jefferson Parishes	New restoration approach in the 2017 *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA 2017a) to promote an integrated, system-wide approach that acknowledges and embraces the interconnected nature of internal marshes, bays, tidal inlets/passes, and barrier islands as they all constitute one system. Program aims to restore and maintain the Terrebonne, Timbalier, and Barataria barrier islands and shorelines as part of a regular rebuilding program.	Conceptual phase; ongoing/as needed	Geology and substrates, hydrology and water quality, air quality, noise	WGT, FI
Bayou Chevee PO-22 (CWPPRA 2003)	Bayou Chevee marsh area, approximately 2 miles west of Chef Menteur Pass, in the Bayou Sauvage National Wildlife Refuge in Orleans Parish, Louisiana	Shoreline protection project consisting of construction of 4,790 feet of rock dike across the mouth of the north cove and 4,020 feet of rock dike across the south cove. The newly constructed rock dikes tie into an existing U.S. Fish and Wildlife Service rock dike.	Completed 2001	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	GT
Biloxi Marsh Living Shoreline Projects PO-0148 (CPRA 2017c)	St. Bernard Parish	Coastal Impact Assistance Program (CIAP) projects to provide shoreline protection to 3 miles of marsh shoreline in St. Bernard Parish around Eloi Point and 1,500 feet of shoreline in Jefferson Parish near Camanada Pass by installing various living shoreline products. Projects also aimed to stimulate oyster growth on the shoreline protection features, thereby enhancing biodiversity in the immediate area	Completed 2017	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	BM
Codfish Point Living Shoreline Stabilization Project (LA TIG 2017; NOAA 2019)	Bayou La Loutre, St. Bernard Parish, Louisiana	Project to stabilize up to 5,700 feet of shoreline by restoring intertidal oyster reef habitat. The installation of bio-induced oyster reefs will help stabilize shorelines, help restore and sustain valuable and sensitive estuarine ecosystems in the Bayou La Loutre headland, provide long-term erosion reduction, and serve as a significant natural storm surge barrier.	A state targeted response was issued for the project area with cleanup completed in 2011.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	BM
CIAP Performance Evaluation – Barrier Island Studies LA-0012-5 (CPRA 2019a)[†]	East Grand Terre, Plaquemines Parish	Project to evaluate Tidal Pass Morphology Post-Restoration at East Grand Terre and Development of Barrier Island Comprehensive Monitoring Program vegetation sampling protocols.	Not constructed	None	WGT
Coastwide Reference Monitoring System (CRMS) LA-30 (CWPPRA 2019b)[†]	Ascension, Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. Mary, St. Tammany, Terrebonne, Vermilion, St. James, St. John the Baptist, St. Martin, Assumption, Jefferson Davis, Acadia, Lafayette, West Baton Rouge, East Baton Rouge, Iberville, Livingston, Tangipahoa Parishes	CWPRRA project designed to monitor the effectiveness of restoration actions at multiple spatial scales from individual projects to the influence of projects on the entire coastal landscape. Monitoring sites are located within nine coastal basins and four CWPPRA regions, covering the entire Louisiana coast. Sites can be found within and outside of CWPPRA coastal restoration and protection projects. Within a CRMS site, there are many CRMS stations or plots. At each site, data are collected at a broader and a finer scale. There are ten vegetation stations and the rod surface and accretion stations are nested around a boardwalk, while hydrologic stations are generally in a bayou or water body near the boardwalk.	Monitoring sites established	Geology and substrates, hydrology and water quality, aesthetics and visual resources	WGT, GT, BM, FI

Project Name/Source	Location	Description	Status/Timing	Potential Impacted Resources	Applicable Alternative(s)*
Coastwide Salvinia Weevil Propagation Facility Project – LA-284 (CWPPRA 2017)†	Ascension, Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. Mary, St. Tammany, Terrebonne, Vermilion, St. James, St. John the Baptist, St. Martin, Assumption, Livingston, and Tangipahoa Parishes	Weevil propagation to control invasive *Salvinia* across 33,262 acres.	Not constructed. Approved for Phase I, Phase II, and Operation in January 2017 (CPRA 2017a).	Geology and substrates, hydrology and water quality, wildlife species, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources	WGT, GT, BM, FI
East Grand Terre Island Restoration BA-30 (CPRA 2017c)	Plaquemines Parish (Borrow area is within the proposed West Grand Terre Alternative disposal area)	Project to restore 2.8 miles and 620 acres of barrier shoreline and 450 acres of marsh by dredging 3.3 million cubic yards of offshore material and rebuilding the island. It was designed under the CWPPRA Program and constructed under the CIAP program as barrier island/headland restoration project.	Completed 2010	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	WGT
Fifi Island Restoration Project BA-0155; Fifi Island Rock and Restoration Project (CRPA 2015a, NOAA 2019)	Jefferson Parish	CIAP project to protection for approximately 100 acres of existing island habitat (Grand Isle and Fifi Island) by the installation of approximately 10,000 linear feet of rock shore protection.	Completed	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	FI
Fisheries Habitat Restoration on West Grand Terre Island at Fort Livingston BA-0186 (CPRA 2015b)	Fort Livingston	National Oceanic and Atmospheric Administration (NOAA) project consisting of a rock dike built to protect the Gulf shoreline of West Grand Terre Island and Fort Livingston. This project was expedited because erosion rates along West Grand Terre rapidly accelerated due to the impacts of tropical storms in 2002.	Completed	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	WGT
Grand Isle Bayside Breakwater BA-0187 (CPRA 2015c)	Gulf coast of southern Jefferson Parish	State project to reduce erosion on the bay side of Grand Isle. Fifteen 300-foot breakwaters were constructed on the back-bay side of Grand Isle.	Completed.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	FI
Grand Isle – Fifi Island Breakwaters BA-0168 (CPRA 2019b)	Jefferson Parish	CPRA/state project to construct rock breakwaters along the southwestern portion of Fifi Island to reduce erosion on Fifi Island and the bay side of Grand Isle in order to protect commercial and residential infrastructure, wetlands, and fisheries.	Completed 2016	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	FI
Grand Isle and Vicinity Projects including Beach and Dune Repair and Breakwaters, BA-0073, BA-0198, BA-0210 (CPRA 2019c, CPRA 2019d, LA TIG 2018a, USACE 2019b)	Gulf coast of southern Jefferson Parish	HSDRRS projects constituting of a 7.5-mile vegetated sand dune extending the length of Grand Isle's gulf shore, a jetty to stabilize the western end of the island at Caminada Pass, and an offshore breakwater system, restoration and protection of beaches and dunes, and a Water Resources Development Act (WRDA) project to stabilize the western portion of beach and dune in Grand Isle in Jefferson Parish. The WRDA stabilization project will consist of the construction of beach, dune, and segmented rock breakwaters.	Projects are on-going. The HSDRRS project was completed 2009, and construction of the breakwaters is expected to begin Q4 in 2019.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, protected species, infrastructure, tourism and recreational use, aesthetics and visual resources, public health and safety	WGT, FI
Greater New Orleans High Level (Project ID: 001.HP.04) (CRPA 2017d)	East Bank of Greater New Orleans, including the southern shore of Lake Pontchartrain and areas west and southwest of Lake Borgne	Improvements of existing Hurricane and Storm Damage Risk Reduction system levees including approximately 202,000 feet of earthen levee and approximately 242,100 feet of T-wall.	Included in 2017 *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA 2017a) Implementation Period II; Planning, Engineering and Design is estimated to take 3 years; Construction is estimated to take 6 years	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, protected species, infrastructure, tourism and recreational use, aesthetics and visual resources, public health and safety	GT

Project Name/Source	Location	Description	Status/Timing	Potential Impacted Resources	Applicable Alternative(s)*
Grand Isle Nonstructural Risk Reduction Project (Project ID: JEF.01N) (CPRA 2017e)	Jefferson Parish	Project includes floodproofing non-residential properties where 100-year flood depths are 1–3 feet, elevating residential properties where 100-year flood depths are 3–14 feet, and acquiring residential properties where 100-year flood depths are greater than 14 feet.	Included in 2017 *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA 2017a) Implementation Period I; In conceptual design phase; expected to take 4 years	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, protected species, socioeconomics, infrastructure, tourism and recreational use, aesthetics and visual resources, public health and safety	FI
Grand Terre Vegetative Plantings Project BA-28 (CWPPRA 2019c, CPRA 2006, NOAA 2019)	The project is located on west Grand Terre Island at the mouth of the Barataria Bay Waterway, east of Grand Isle in Jefferson Parish, Louisiana.	Coastal restoration project to stabilize the dredged material platform to maintain the integrity of the island. Project features include the installation of vegetation utilizing hand planted nursery grown selected plant species, including 35,000 vegetative plugs of smooth cordgrass and 600 tube containers of black mangrove planted near the rock containment dike on the Barataria Bay side of the project area. Additional plantings on the foredune outside of the disposal area include 3,100 four-inch containers each of marshhay cordgrass, bitter panicum, and gulf cordgrass. Project measures also include the removal of feral herbivores (approximately 20 goats and 70 cows) from the island to prevent overgrazing and impacts to native and planted vegetation.	Completed 2001 – project is being monitored	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	WGT
Informed Restoration: Assessing the uptake of Deepwater Horizon-derived heavy metals and organic contaminants by coastal molluscan species in the Gulf of Mexico (NOAA 2019)	Jefferson Parish, Louisiana; Mobile, Alabama; Franklin, Florida	Monitoring project to assess the impact of the Deepwater Horizon spill on a variety of shellfish in coastal areas of the Gulf of Mexico, since May 2010. Monitoring has consisted of examination of both the shells and soft-tissues of specimens collected from May through August 2010 to search for reliable indicators of exposure to and incorporation of crude oil components, namely specific heavy metals such as vanadium, lead, nickel and chromium, and particular organic polycyclic aromatic hydrocarbons (PAHs).	Completed	Geology and substrates	FI
Lake Pontchartrain & Vicinity (LPV) Risk Reduction and Task Force Guardian Mitigation Projects, PO-63, PO-0182 (CPRA 2019e, 2019f, 2019g, 2019h), USACE n.d.)[§]	Various locations in the Lake Pontchartrain Basin including Greater New Orleans Area on the east bank of the Mississippi River and Bayou Sauvage	HSDRRS projects designed to provide 100 Year protection levels to the Greater New Orleans area on the East and West Banks of the Mississippi River in St. Charles, Jefferson, Orleans and St. Bernard Parishes. Projects include rehabilitation or new construction on over 150 miles of the levees and structures that will make up the Lake Pontchartrain and Vicinity Hurricane Protection System; efforts to investigate the raising of the levees and other enhancements for the LPV and West Bank and Vicinity (WBV) projects to provide the level of risk reduction necessary to achieve the certification required for participation in the National Flood Insurance Program under the base flood elevation; and the evaluation of over 400 potential mitigation features to compensate for 1,179 acres of impacted habitats from the LPV hurricane project.	Various timelines. The levees were constructed in 2017 and the investigations for National Flood Insurance Program were completed in 2015. Raising of levees and other enhancements are in the feasibility and planning stage	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT
Marshalling the Mussel for Shoreline Stabilization (NOAA 2019)	Jefferson Parish	Project to provide alternative to the use of oyster reefs for shoreline protection through identifying areas suitable for ribbed mussel growth and shoreline enhancement, using wild-stock hatchery to produce ribbed mussel pediveligers, and conducting preliminary tests at selected marsh locations of deployment. The enhancement of ribbed mussel populations may be a low-cost alternative to traditional shoreline protection (rocks), and created oyster reefs using bio-engineered materials, since mussel larvae are easily moved from a hatchery using standard remote setting techniques. This proposed project addresses restoring the function and productivity of Louisiana's degraded ecosystem by focusing on a strategy to restore damaged and lost wetlands to the functional equivalent of natural ecosystems based on realistic ecological metrics, hydrologic requirements, and design criteria.	In planning/design phase	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	FI
Mississippi River Gulf Outlet (MRGO) and Lake Borgne (Bayou Bienvenue Segment) PO-94 (CPRA 2016)	St. Bernard Parish	Federal shoreline protection project to construct approximately 14,440 linear feet of stone foreshore dike along the southwest shoreline of Lake Borgne in the vicinity of Bayou Bienvenue. CPRA is acquiring portions of the three oyster leases that are impacted by this project.	Completed	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, socioeconomics, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT
New Orleans East Landbridge SP and Marsh Creation 001.MC.05 (CPRA 2017c) PO-0169) (CPRA 2019i)	Orleans Parish; St. Tammany Parish	Marsh creation project to create approximately 33,400 acres of marsh in the New Orleans East Landbridge to create new wetland habitat and restore degraded marsh.	Included in 2017 *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA 2017a) Implementation Period I & II; Planning, Engineering, and Design is estimated to take 3 years. Construction is estimated to take 18 years.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, socioeconomics, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT

Project Name/Source	Location	Description	Status/Timing	Potential Impacted Resources	Applicable Alternative(s)*
New Orleans to Venice Mitigation – Fed BA-159 (CPRA 2019e; USACE n.d.)‡	Plaquemines Parish	HSDRRS project to provide mitigation for USACE impacts incurred during construction of the New Orleans to Venice (NOV) Plaquemines Non-Federal Levee protection projects and involves the restoration of approximately 230 acres of Bottomland Hardwood, Marsh, and Swamp in the Barataria Basin.	Not constructed; In feasibility and planning stage	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT
New Orleans to Venice Mitigation - Plaquemines Non-Fed BA-158 (CPRA 2019d; USACE n.d.)‡	Plaquemines Parish	Federally funded USACE/HSDRRS project to provide mitigation for impacts during construction of the WBV Pre-Katrina (2005) Hurricane protection projects and involves the restoration of approximately 1,217 acres of swamp and bottomland hardwood habitats in the Barataria Basin.	Not constructed; In feasibility and planning stage	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT
Southeast Louisiana Urban Flood Control Project (SELA) PO-0057 (CPRA 2019c; USACE 2019c)	Located throughout the City of New Orleans and the Parish of Jefferson, on both the east and west banks of the Mississippi River in Jefferson and Orleans Parishes.	HSDRRS hurricane protection project to reduce damages from rainfall flooding in Orleans, Jefferson, and St. Tammany parishes through increases in pump station capacity, and improvements in surface and sub-surface drainage features.	In construction	Geology and substrates, hydrology and water quality, air quality, noise, socioeconomics, public health and safety	GT
Storm-Proofing of Interior Pumping Stations BA-0074 (CPRA 2018, 2019h; 2019e)	This project is located at various pumping stations throughout the Greater New Orleans Area. Jefferson, Orleans, Plaquemines, St Charles	Hurricane protection project consisting of additions of various improvement features to the interior pump stations of Orleans and Jefferson Parish HSDRRS. These improvements were done to allow the pump stations to remain operable during and after future storm events. Examples of stormproofing include raising critical components to avoid submersion during floods and adding backup power and fuel sources.	Completed 2015	None	GT
System Wide Assessment & Monitoring Program (CPRA 2014)†	Louisiana Coastal Region	Coastal monitoring project to ensure a comprehensive network of coastal data collection activities is in place to support the development and implementation of the coastal protection and restoration program	Not constructed	None	WGT, GT, BM, FI
Energy Activities					
Energy facilities including pipelines, transmission lines, wells, etc.	Jefferson Parish, Orleans Parish, St. Bernard Parish, Plaquemines Parish	Existing oil and gas wells, pipelines, transmission lines, and energy facilities throughout each alternative's cumulative effect analysis area.	Completed	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, socioeconomics, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	WGT, GT, BM, FI
Tourism and Recreation					
Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase I (PO-16) (CWPRRA 2006)	Orleans Parish - Channel of Bayou Sauvage, Bayou Sauvage NWR	Recreation project to promote public access and recreational use through hydrologic restoration of the Bayou Sauvage National Wildlife Refuge (NWR). The project will involve the use of bucket dredging to restore the channel of Bayou Sauvage, Bayou Sauvage NWR. The dredge spoil is to be used beneficially to restore cypress and live oak along bayou shoreline. This is not a navigation project (LA TIG 2018).	Completed 1996	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, socioeconomics, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	GT
Grand Isle State Park Improvements BA-0214 (CPRA 2019d; LA TIG 2018a)	Jefferson Parish	State park improvements to include campground improvements, pothole repairs, nature trails resurfacing, road repairs and improvements, sewer treatment plant installation, road striping, trail improvements, road and park painting. Improvements include increased accessibility for persons with disabilities. An extension and upgrade of the fishing pier at Grand Isle State Park (Louisiana Office of State Parks), will provide for an additional 400 feet of pier, associated lighting, and a fish cleaning station. Additional funding would provide for upgrades to the existing rock groins (aka, the rock jetty) which keeps beach erosion – and general topography subsidence – to a minimum.	Various statuses and timelines. The Fishing Pier at Grand Isle is in engineering and design.	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	WGT

Project Name/Source	Location	Description	Status/Timing	Potential Impacted Resources	Applicable Alternative(s)*
Other					
Louisiana Department of Wildlife and Fisheries (LDWF) Lyle S. St. Amant Marine Laboratory	West Grand Terre Island	The LDWF Lyle S. St. Amant Marine Laboratory is an abandoned scientific research and investigation facility built in 1957 to support Louisiana's fishing industry. It is located on the west end of West Grand Terre Island, and the lab will be partially demolished to accommodate the construction of the West Grand Terre Beach Nourishment and Stabilization Alternative. The facility no longer retains integrity to convey its significance, and the Louisiana State Historic Preservation Officer (SHPO) has concurred that facility is not eligible for listing in the National Register of Historic Places (Louisiana Division of Historic Preservation 2019).	Prior to construction of WGT	Geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, socioeconomics, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, public health and safety	WGT
BOEM Major Shipping Fairway (BOEM 2019)	East of West Grand Terre Island	Major shipping lane associated with ports in the Gulf of Mexico.	Established; no associated construction	Hydrology and water quality, air quality, noise, marine and estuarine fauna, tourism and recreational use, marine transportation, aesthetics and visual resources, public health and safety	WGT

* BM = Biloxi Marsh Living Shoreline alternative; GT = Golden Triangle Marsh Creation alternative; FI = Fifi Island Forested Ridge and Breakwater alternative; WGT = West Grand Terre Beach Nourishment and Stabilization alternative

† This project is not mapped because a) it covers a large area including and beyond the CIAA and/or is program or monitoring effort without a specific physical location or infrastructure.

‡ This project is not mapped, because the mitigation basins cover a large portion of or the entire CIAAs for the listed alternatives. Locations for many specific projects have not been finalized.

§ This category is intended to capture projects that do not fall within the Final PDARP/PEIS category list.

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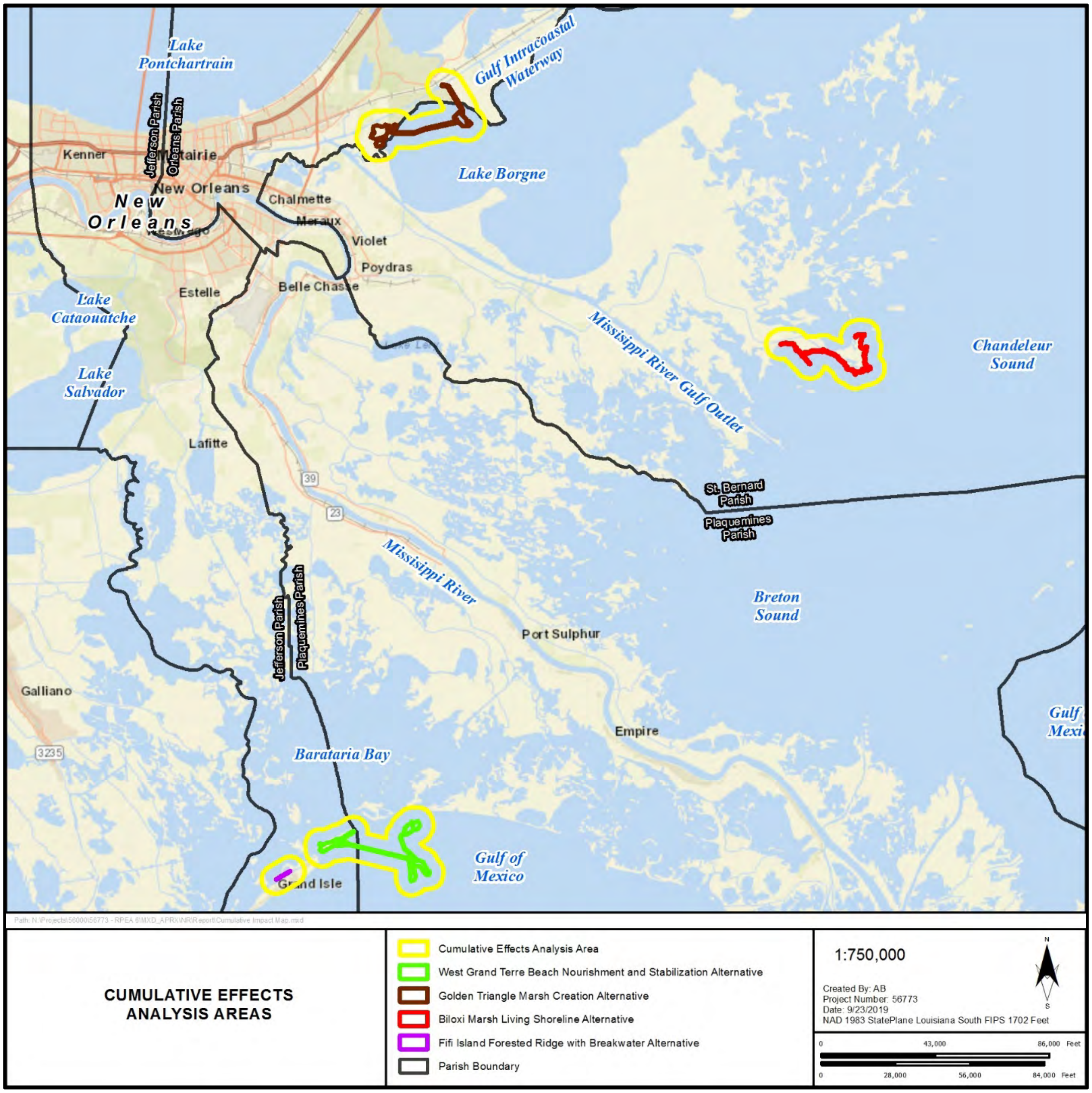

Figure F-1. Cumulative impacts (effects) analysis areas.

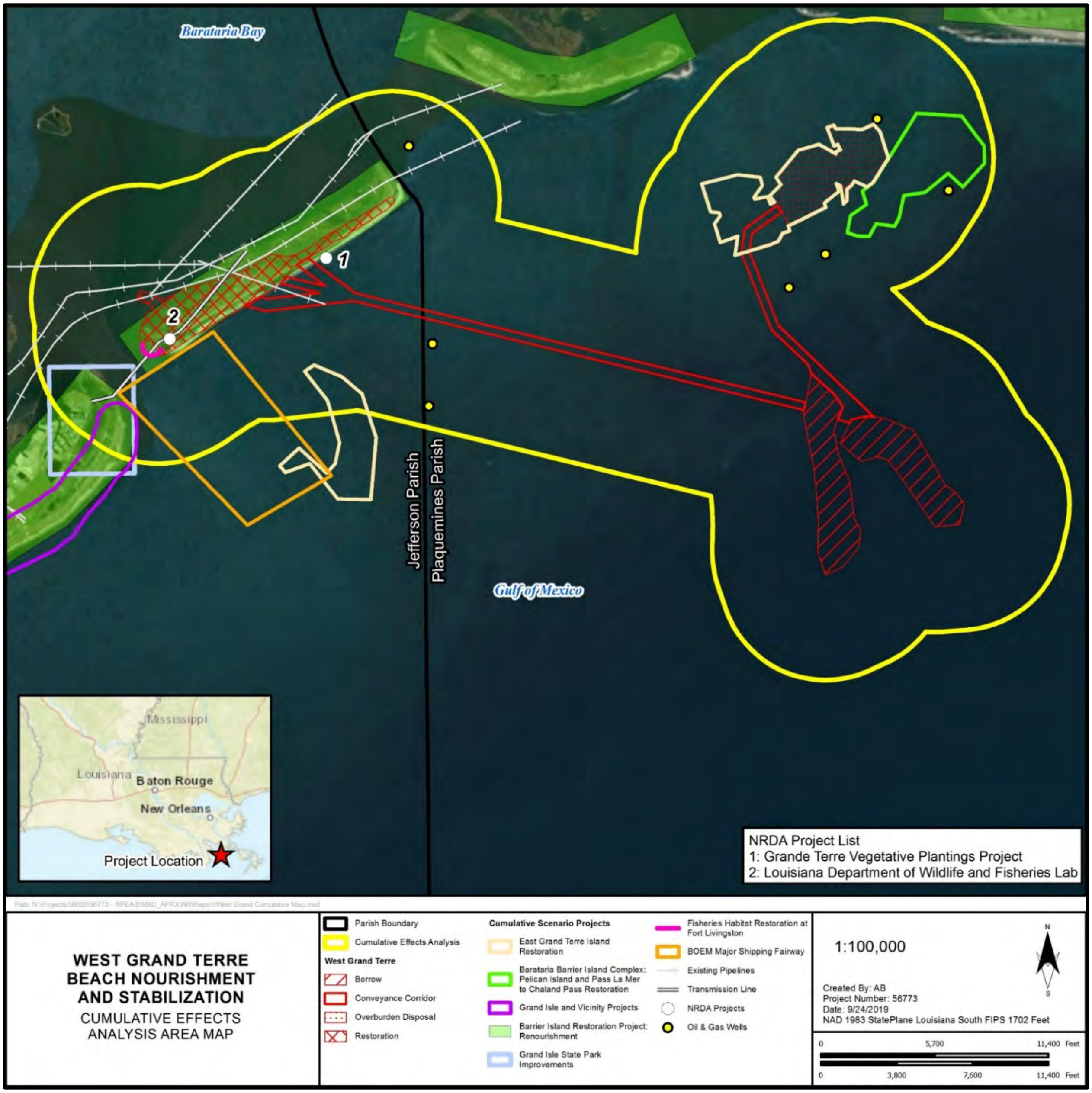

Figure F-2. West Grand Terre Beach Nourishment and Stabilization cumulative impacts (effects) analysis area.

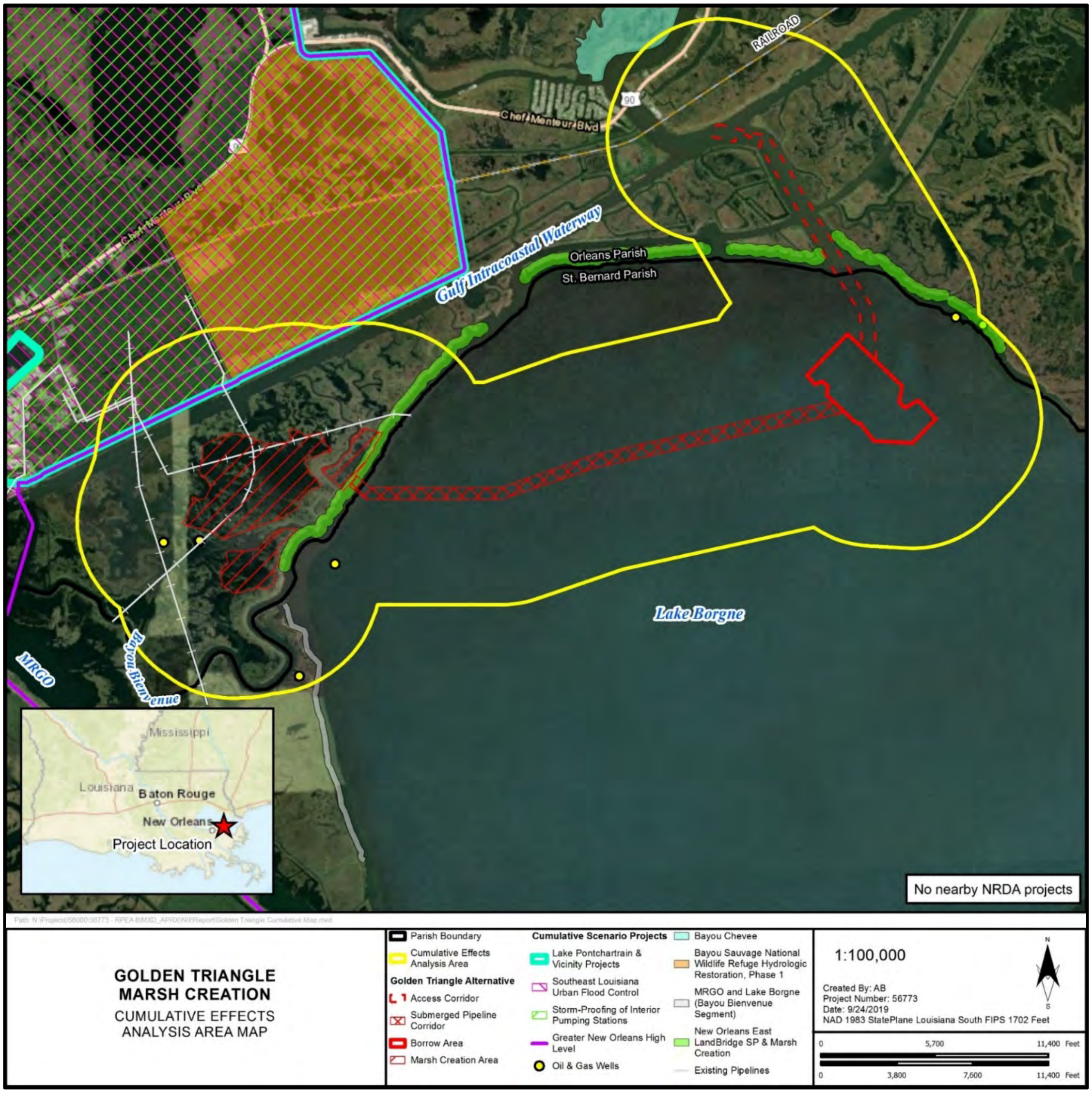

Figure F-3. Golden Triangle Marsh Creation cumulative impacts (effects) analysis area.

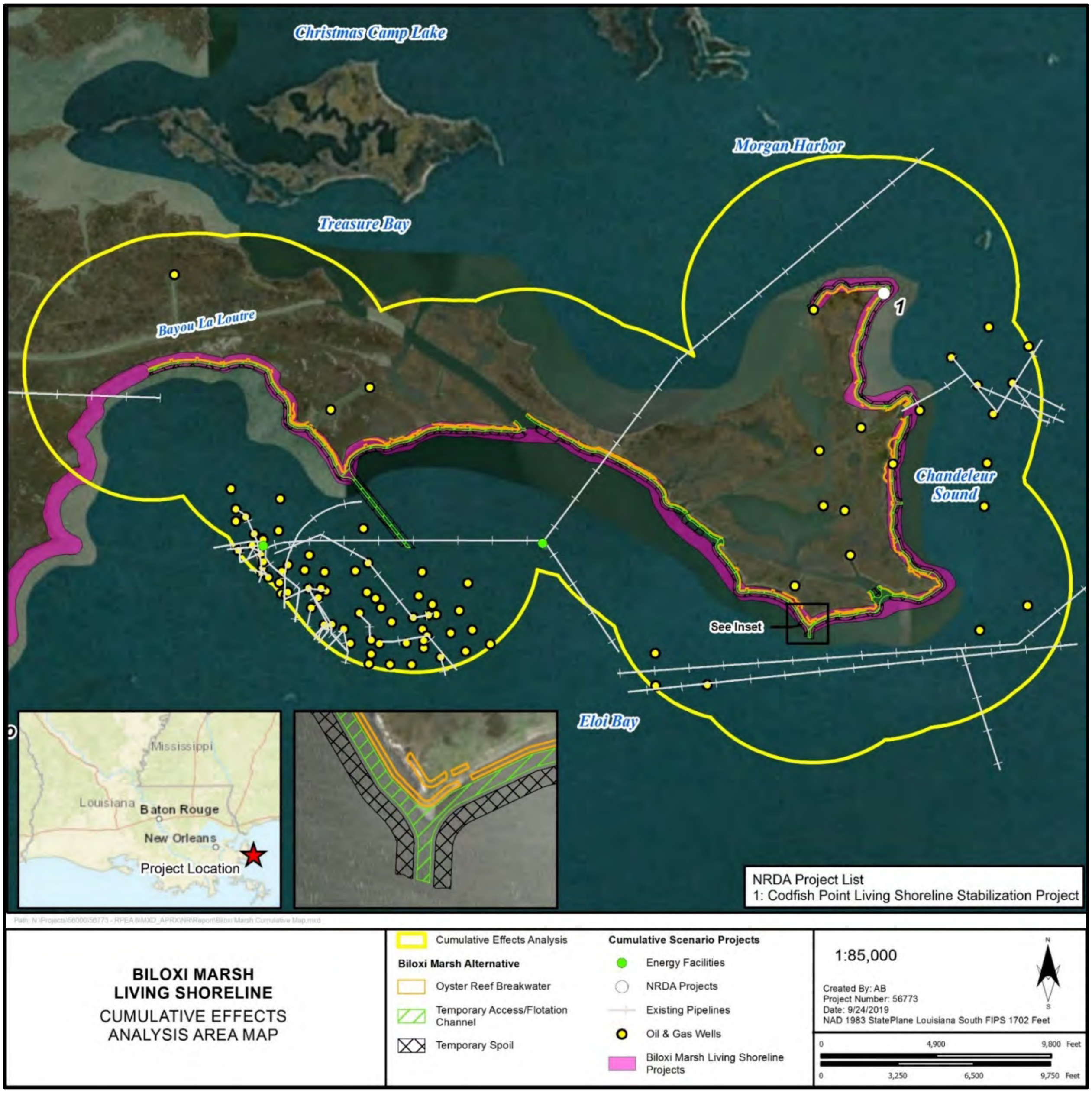

Figure F-4. Biloxi Marsh Living Shoreline cumulative impacts (effects) analysis area.

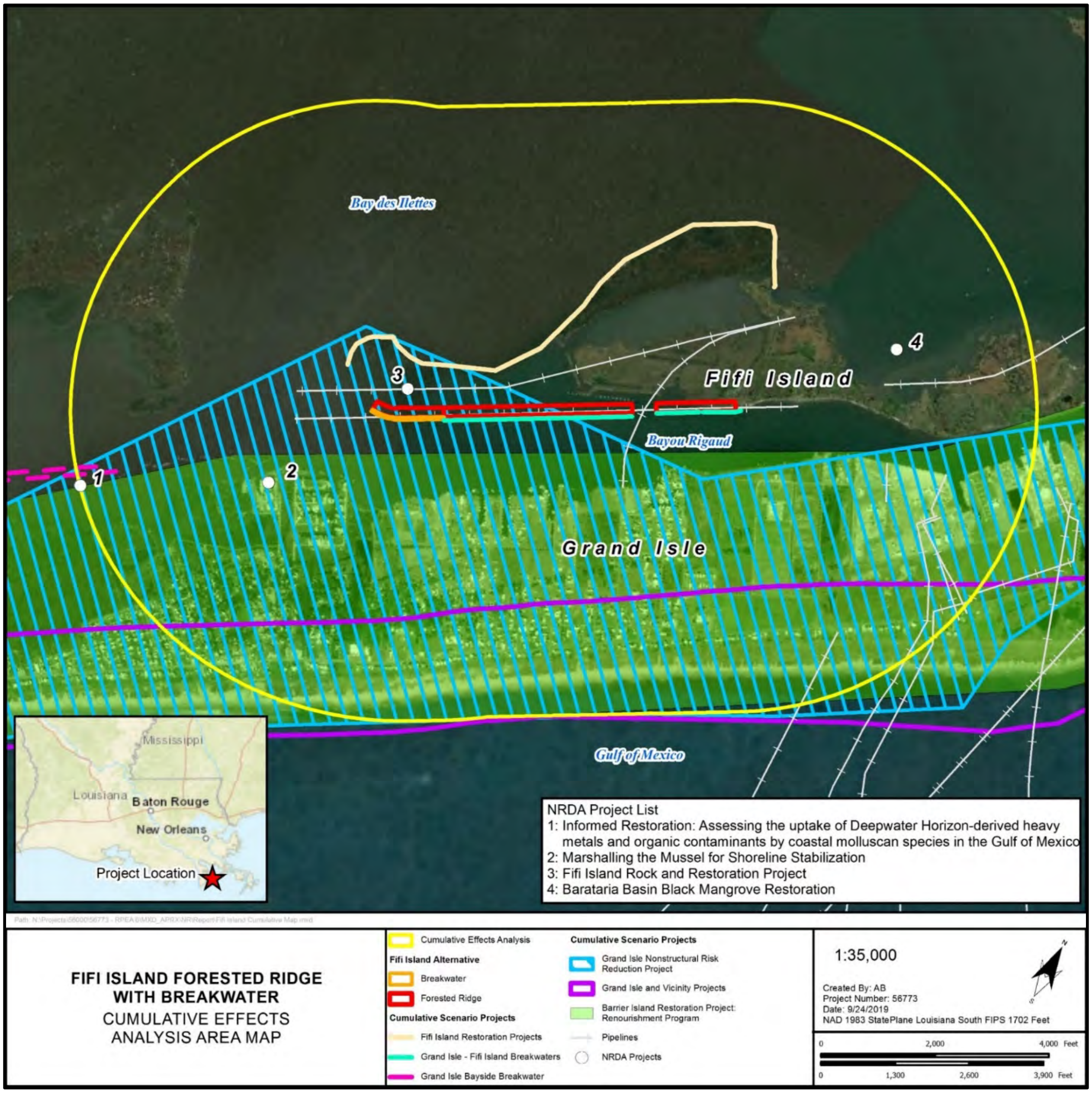

Figure F-5. Fifi Island Forested Ridge with Breakwater cumulative impacts (effects) analysis area.

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