

## REPORT SUMMARY

### MISSISSIPPI RIVER GULF OUTLET (MRGO) ECOSYSTEM RESTORATION PROJECT

Feasibility Scoping Meeting:	23 APR 2009
Alternative Formulation Briefing:	22 APR 2010
AFB Guidance Memorandum:	14 JUL 2010
Draft Report Guidance Memorandum:	31 OCT 2011
Division Engineer Transmittal:	01 JUN 2012
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CWRB Briefing:	14 JUN 2012
30-Day S&A Review start:	N/A
30-Day S&A Review end:	N/A
FEIS filed with EPA:	N/A

## STUDY INFORMATION

**Study Authority.** The feasibility study is being conducted under the authority of the Water Resources Development Act (WRDA) 2007 Section 7013. The act reads as follows:

*“SEC. 7013. MISSISSIPPI RIVER-GULF OUTLET.*

*(a) DEAUTHORIZATION.-*

*(3) CLOSURE AND RESTORATION PLAN.-*

*(A) IN GENERAL.-Not later than 180 days after the date of enactment of this Act, the Secretary shall submit to the Committee on Environment and Public Works of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a final report on the deauthorization of the Mississippi River-Gulf outlet, as described under the heading "INVESTIGATIONS" under chapter 3 of title II of the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (120 Stat. 453).*

*(B) INCLUSIONS.-At a minimum, the report under subparagraph (A) shall include-*

*(i) a plan to physically modify the Mississippi River-Gulf Outlet and restore the areas affected by the navigation channel;*

*(ii) a plan to restore natural features of the ecosystem that will reduce or prevent damage from storm surge;*

*(iii) a plan to prevent the intrusion of saltwater into the waterway;*

*(iv) efforts to integrate the recommendations of the report with the program authorized under section 7003 and the analysis and design authorized by title I of the Energy and Water Development Appropriations Act, 2006 (119 Stat. 2247); and consideration of-*

*(I) use of native vegetation; and*

*(II) diversions of fresh water to restore the Lake Borgne ecosystem.*

*(4) CONSTRUCTION.-The Secretary shall carry out a plan to close the Mississippi River-Gulf Outlet and restore and protect the ecosystem substantially in accordance with the plan required under paragraph (3), if the Secretary determines that the project is cost-effective, environmentally acceptable, and technically feasible.”*

**Study Sponsor.** The study is 100% Federally funded. No non-Federal sponsor has been identified to implement the ecosystem restoration plan. The State of Louisiana has actively participated on the planning team and supports the plan. The state disagrees with USACE over the cost-share requirements for plan implementation and has expressed its unwillingness to participate unless it is undertaken at full Federal cost. The USACE will continue to coordinate with the state to finalize the plan and to identify a non-Federal sponsor.

**Study Purpose and Scope.** Congress authorized the MRGO in 1956 as a Federal navigation channel to provide a short route between the Port of New Orleans and the Gulf of Mexico. Channel construction began in 1958 and was completed in 1968. In August 2005, Hurricane Katrina caused shoaling in the MRGO channel limiting its depth to 22 feet, and thus restricted deep-draft vessel access. Rather than continue funding operation and maintenance of the channel, in June 2006, Congress requested a plan for deauthorization of the MRGO (see PL 109-234). A rock closure structure across the MRGO near Bayou La Loutre was completed in July 2009.

This feasibility study supplements the MRGO Deep-Draft De-Authorization Report, fully meets the requirements of WRDA 2007 Section 7013, and will result in a Report of the Chief of Engineers describing the federally identified plan and recommending construction of features for early implementation contingent upon the identification of a non-Federal sponsor. The purpose of the study is to recommend plans for the restoration of aquatic ecosystem structure and function in the Lake Borgne ecosystem and areas affected by the previously authorized channel project.

**Project Location/Congressional District.** The study area (Figure 1) includes approximately 3.84 million acres (6,023 square miles) of land and open water. The area is located in Louisiana Congressional Districts 1, 2, and 3; and Mississippi Congressional District 4.

## MISSISSIPPI RIVER GULF OUTLET (MRGO) ECOSYSTEM RESTORATION PLAN

The MRGO Study Area



Figure 1. Mississippi River Gulf Outlet (MRGO) Study Area Location

**Prior Reports and Existing Water Projects.** Water project information related to the MRGO has been accumulated over more than five decades. This study builds upon existing studies, reports and plans. Where conditions have changed or new information is available, additional analyses have been performed to develop a restoration plan based on sound science and engineering.

**Federal Interest.** Aquatic ecosystem restoration is a primary mission of the Corps of Engineers Civil Works program, and is defined as achieving a “return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions” (EP 1165-2-502.) The need to reduce the loss of Louisiana coastal wetlands has been further recognized by the Executive Branch and Congress. The Coastal Wetlands Planning, Protection and Restoration Act program (CWPPRA) provides targeted funds through 2019 used for planning and implementing projects that create, protect, restore and enhance wetlands in coastal Louisiana. The Coastal Impact Assistance Program (CIAP) was authorized by Section 384 of the Energy Policy Act of 2005, to assist coastal producing states and their political subdivisions in mitigating the impacts from Outer Continental Shelf (OCS) oil and gas production.

In October 2009, President Obama formed the Louisiana-Mississippi Gulf Coast Ecosystem Restoration Working Group that developed a Roadmap for Restoring Ecosystem Resiliency and Sustainability in the Louisiana and Mississippi Coast. The Working Group found that “bold and decisive action is needed now to curtail the rate of wetland loss and barrier island erosion in the area and to restore some of these lost features and ecosystem services.”

The Nation derives significant benefits from the coastal Louisiana ecosystem: protection for the production and transport infrastructure for about 30 percent of the country’s oil and gas supply; the Nation’s second largest commercial fishery; and navigation and port facilities which together support America’s number one port complex by tonnage.

The plan would restore resources that are institutionally and technically significant due to scarcity and importance, and resources protected by the Endangered Species Act of 1973; Fish and Wildlife Conservation Act of 1980; Fish and Wildlife Coordination Act of 1958; Migratory Bird Conservation Act; and other legislation.

Louisiana coastal wetlands provide essential stopover habitat for neotropical migratory birds on their annual migration route. Coastal wetlands provide important and essential fish and wildlife habitats, used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. Water bodies and wetlands in the area provide nursery and foraging habitats supportive of a variety of economically important marine fishery species.

Wetlands of national interest that would benefit from the implementation of the FIP include those found in the Bayou Sauvage National Wildlife Refuge and the Pearl River and Biloxi Wildlife Management Areas.

## STUDY OBJECTIVES

### Problems and Opportunities.

Table 1. Plan Formulation Problems and Opportunities

Problems	Opportunities
Decreased Freshwater, Sediment, and Nutrient Inputs	Increase sediment, freshwater, and nutrient inputs Increase organic deposition.
Modification of Natural Hydrology	Restore altered tidal circulation patterns and improve water quality.
Saltwater Intrusion	Prevent saltwater intrusion.
Wetland Loss	Create wetlands, nourish, and prevent the continued loss of wetlands.
Ridge Habitat Degradation and Destruction	Restore ridge habitat.
Bank/Shoreline Erosion	Prevent bank and shoreline erosion.
Habitat Changes and Loss	Restore habitat types such as swamps, ridges, submerged aquatic vegetation, oyster reefs, and barrier islands.
Invasive Species	Eliminate or reduce invasive species.
Herbivory	Prevent herbivory.
Retreating and Eroding Barrier Islands	Restore barrier islands.
Human Development Susceptible to Storm Surge	Reduce or prevent storm surge damage through restoration of natural ecosystem features.

**Planning Objectives.** Planning objectives were developed to address systemic ecosystem problems and the Congressional study authority. The study objectives were developed to address the habitat impacts of the MRGO to restore area biodiversity and ecosystem function. The storm surge risk reduction component of the authority was addressed by restoration of critical landscape features.

The objectives for the MRGO Ecosystem Restoration Plan follow:

1. Restore historic salinity conditions in the study area to re-establish and maintain historic habitat types; optimize ecosystem services; and decrease stress to vegetation as measured by monthly salinity targets in the Biloxi Marsh (as identified by Chatry et al. 1983) each month of the year, for at least four years out of every ten year period.
2. Restore native habitat acreages impacted by the MRGO and their ecosystem functions. Increase the year round spatial coverage of habitats as follows:
  - a. cypress swamp habitat in the Central Wetlands by at least 9,500 acres by 2065.
  - b. fresh/intermediate marsh in the Central Wetlands, Golden Triangle, MRGO, and South Lake Borgne by at least 6,800 acres by 2065.
  - c. brackish marsh in Bayou Terre aux Boeufs, the Biloxi Marsh, and the East Orleans Landbridge by at least 18,100 acres by 2065.

- d. vegetated wetlands in areas adjacent to the channel lost to increased tides and salinity by at least 3,900 acres by 2065.
  - e. ridge habitat along Bayou La Loutre by 2065.
3. Increase the year round spatial coverage of critical landscape features that provide hurricane and storm damage risk reduction in the study area (i.e. areas located in the Biloxi Marshes, the East Orleans Landbridge, and forested habitats).
  4. Increase awareness and understanding of resource significance in the area through increased recreational and educational opportunities.

**Planning Constraints.** Planning constraints are restrictions that limit the extent of the planning process. For this study, the planning constraints are:

- Avoid or minimize negative impacts to threatened and endangered species to the extent practicable.
- Avoid or minimize impacts to critical habitat to the extent practicable.
- Do not diminish the level of protection provided by authorized flood risk reduction projects.
- Avoid actions that negatively affect the ability of navigation projects to fulfill their purpose to the extent practicable.
- Minimize impacts to commercial fisheries (such as oysters).
- Avoid or minimize contributions to low dissolved oxygen concentrations or conditions that could result in detrimental algal blooms.

## **ALTERNATIVES**

**Plan Formulation Rationale.** Alternative plans are formulated across a range of scales to demonstrate the relative effectiveness of various approaches. Alternatives were formulated recognizing problems and opportunities, as well as study goals, objectives and constraints with consideration of the Principles and Guidelines (P&G) criteria: completeness, effectiveness, efficiency, and acceptability.

**Management Measures and Alternative Plans.** A management measure is a feature (a structural element that requires construction or assembly on-site) or an activity (a nonstructural action) that can be combined with other measures to form alternative plans. Management measures were derived from a variety of sources (prior studies, the public scoping process, etc.) and were developed to address problems and to capitalize upon opportunities.

Approximately 300 initial management measures were considered, and include: freshwater diversions; hydrologic restoration; marsh creation, marsh nourishment, and swamp creation or restoration; shore protection; ridge restoration; restoration of forested habitat; vegetative plantings; barrier island restoration; submerged aquatic vegetation (SAV) restoration; and oyster reef restoration.

Several measures were considered necessary components of a plan that addressed the study authority, considered the significance of ecosystem outputs, and met the goals and objectives for the study. A

minimum planning increment was included in the plan formulation process to produce the alternatives of the study. The minimum planning increment defines the minimal amount of improvement necessary to achieve functional restoration of the resources. Alternatives considered consisted of:

- **Cypress and Coastal Ridge Habitat:** In an abstract evaluation, cypress and coastal ridge restoration measures are not as cost-effective as other measures. These restoration measures require more sediment and more time to achieve benefits than marsh restoration, and therefore have much higher costs compared to benefits. Restoring cypress and ridge habitat was considered necessary to fulfill the study authority requirements to “restore the areas affected by the navigation channel,” as documented in Habitat Impacts of the Construction of the MRGO and Louisiana Coastal Area Ecosystem Restoration Study (USACE 1999, 2004).
- **Recommendations for MRGO Channel:** Similarly, the inclusion of some features in the MRGO is required to address the LCA Near-Term Project described in Section 7006 (c)(1)(A) and the portion of the 7013 authority requiring “a plan to physically modify the Mississippi River-Gulf Outlet”, despite the relative cost-effectiveness of these features. Bank reclamation and stabilization along the MRGO is important to prevent the further confluence of the MRGO and Lake Borgne and to maintain the MRGO/Lake Borgne Landbridge. A plan that did not include features in the MRGO would likely be unacceptable to the public and did not appear to meet the Congressional intent of the study. Stabilizing the MRGO banks would preserve estuarine wetlands and important structural features of the landscape. The MRGO features would prevent future land loss and restore previously degraded wetlands; stabilize and restore the Lake Borgne rim geomorphic structure; and protect vital socioeconomic resources, such as communities located adjacent to the MRGO.
- **Violet Freshwater Diversion:** Alternatives without a freshwater diversion were initially considered. These alternatives were ultimately eliminated from further study as inconsistent with the study goals and objectives. Further study of the Violet Freshwater Diversion, under WRDA 2007 Section 3083, is an important component of the plan to restore historic salinity conditions and nourish existing and restored wetlands.

**Final Array of Alternatives.** The Corps' Institute for Water Resources (IWR) has developed procedures and software to assist in conducting cost effectiveness and incremental cost analyses (CE/ICA). IWR-PLAN Decision Support Software was used to assist in performing CE/ICA. IWR-PLAN software generated 6,721 plan combinations. Including the No Action plan (Plan A), there were 285 cost-effective plans and 19 Best Buy plans ranging in costs up to \$6.5 Billion.

Three Best Buy plans generated using IWR-PLAN software, along with the No Action plan, were selected for the final array. Best Buy plans #2, #7, and #10 (Plans B, C, and D, respectively) were chosen based on cost effective increments based on their contribution to addressing the study authority and achieving the planning objectives. These plans also represent a wide range of costs and outputs.

Plan B includes 10,287 acres of brackish marsh restoration and nourishment on the East Orleans Landbridge and the Bayou Terre aux Boeufs area. 9,343 acres of intermediate marsh in South Lake Borgne and along the MRGO would be restored as part of Plan B. Cypress swamp restoration and nourishment in the Central Wetlands (10,318 acres) are included in Plan B. Coastal ridge habitat restoration along Bayou La Loutre is also a component of Plan B (54 acres). Along the MRGO, Plan B includes approximately 32.5 miles of bank protection and 548 acres of marsh restoration. Plan B does not include any shoreline protection features along Lakes Borgne or Pontchartrain, oyster reef restoration, or restoration features in the Biloxi Marsh. Further analysis of the Violet Freshwater Diversion as described in WRDA 2007 Section 3083 is also included as a component of Plan B.

Plan C includes all of the measures in Plan B and adds 22,224 acres of brackish marsh restoration and nourishment on the East Orleans Landbridge, Bayou Terre aux Boeufs, Hopedale and the Biloxi Marsh. Plan C also includes the restoration and nourishment of 3,281 acres of imperiled fresh marsh in the Central Wetlands and 280 acres of intermediate marsh at the confluence of the MRGO and GIWW. Restoration of globally scarce oyster reef habitat is proposed for 5.8 miles of the Biloxi Marsh shoreline as part of Plan C. Approximately 41 miles of shoreline protection features included in Plan C fill in the gaps between existing and planned projects, creating a complete plan for the protection of the East Orleans Landbridge and the Lake Borgne shoreline.

Plan D incorporates all of the measures in Plan C and adds 12.8 miles of shoreline protection in the Biloxi Marsh and an SAV restoration measure in Lake Pontchartrain.

Plan B was chosen for further consideration because it was the least costly Best Buy Plan. Plan B does not achieve all of the goals and objectives of the study, but it does include some restoration measures for all of the targeted habitat types. Plan B does not meet the target acre objectives for brackish marsh. Plan B has no features in the Biloxi Marsh and only includes two features on the East Orleans Landbridge: therefore, Plan B does not fully address the objective to restore and protect critical landscape features.

Plan C is the first Best Buy Plan that meets all of the objectives, including reasonably maximizing restoration and protection of the Biloxi Marsh and East Orleans Landbridge. Plan C was selected for further evaluation in the final array of alternatives because it appeared to be a complete plan for the Lake Borgne ecosystem and the areas affected by the MRGO.

Plan D includes additional restoration measures in the Biloxi Marsh and East Orleans Landbridge. Because of these additions, Plan D improves upon Plan C by further protecting these critical

landscape features, and better meets the storm surge objective. Plan D was included for further evaluation because it was the first Best Buy after Plan C to include more measures to protect both of these features. Table S-1 provides a summary of each plan in the final array of alternatives.

Table 1. Final Array of Alternatives

Plan	Estimated Construction Cost <sup>1</sup>	Measure AAHUs <sup>2</sup>	Plan AAHUs <sup>3</sup>	Acres Restored <sup>4</sup>
A	\$0	0	0	0 <sup>5</sup>
B	\$1.7 B (\$67 M annual)	6,008	13,608	30,250
C	\$2.9 B (\$124 M annual)	10,324	17,575 <sup>6</sup>	58,861
D	\$3.1 B (\$130 M annual)	10,399	17,116	59,823

Notes:

1. Based on preliminary costs in \$FY 2010. Does not include real estate, OMRR&R, or adaptive management costs.
2. The AAHUs presented in this column are the total AAHUs of all measures in the plan added together and does not consider interactions between restoration features, except for areas influenced by the freshwater diversion. The influence of the authorized Violet Freshwater Diversion was considered in the calculation of all benefits in this table.
3. The AAHUs in this column are based on the Wetland Value Assessments (WVAs) for the entire plan, and does consider synergies.
4. The acres in this column are the total acres restored, nourished, and protected by the plan.
5. The table shows only the costs and benefits associated with this plan. Therefore, all values are zero for the no-action plan.
6. This number is reflective of the initial WVAs that were performed for the project in the plan formulation phase. WVAs were revised for the FIP based on a revised WVA methodology. In this final plan analysis, the Violet Freshwater Diversion was assumed operational in 2027. The total AAHUs for Plan C considering synergies is now 37,980 because the revised methodology considers the value of existing habitat, significantly increasing total benefits.

**Comparison of Alternatives.** Alternative plans were compared against each other, with emphasis on the outputs and effects (beneficial and adverse) with respect to study objectives and NER benefits and costs. Table 2 provides a summary of how each alternative plan meets the study objectives.

Plans A and B were not selected because they do not fully achieve all of the study objectives and would not comply with Congress’ mandate in WRDA 2007, Section 7013. Plan C is the lowest cost plan that fully achieves all of the planning objectives and provides a complete plan to restore the Lake Borgne ecosystem. Key features and processes would be restored in Plan C. Plan C provides significantly greater benefits at a relatively small increase in average costs, and therefore better meets the effectiveness criteria than Plan B. Plan D would provide more benefits to the ecosystem than Plan C; however, in this evaluation, the additional benefits do not justify the increased cost. Plan D is a cost effective means of achieving the objectives of the study, but due to increased incremental costs compared to Plan C, it is not the most efficient plan. Plan C is the FIP for this study because it is the lowest cost alternative that meets all of the study objectives and provides a complete plan to restore the structure and function of the Lake Borgne ecosystem.

Table 2  
Comparison of the Alternative Plans and Plan Objectives

Objective	Plan A	Plan B	Plan C	Plan D
1. Salinity Target	No	Yes	Yes	Yes
2. Cypress (Minimum 9,500 acres)	No	Yes	Yes	Yes
3. Fresh/Intermediate (Minimum 6,800 acres)	No	Yes	Yes	Yes
4. Brackish (Minimum 18,100 acres)	No	No	Yes	Yes
5. Various Marsh types lost from increased tides and salinity (Minimum 3,900 acres)	No	No	Yes	Yes
7. Ridge Habitat	No	Yes	Yes	Yes
8. Landscape Features for Surge Reduction <sup>a</sup>	No	Yes 5,100 acres	Yes 20,234 acres	Yes 21,165 acres

<sup>a</sup>Landscape features for surge reduction include acres restored, nourished or protected on the East Orleans Landbridge and the Biloxi Marsh.

**Key Assumptions.** A number of assumptions helped guide the plan formulation process and the overall recommendation:

Table 3 Key Assumptions	
Assumption	Rationale for the Assumption
<b>Study Area</b>	
The MsCIP (Mississippi Coastal Improvements Program) will address ecosystem restoration needs in Mississippi. Except for diversions of freshwater, the study will not formulate measures for the purpose of ecosystem restoration in Mississippi.	The MsCIP Comprehensive Plan addressed ecosystem restoration needs. To avoid redundancy and ensure consistency with that plan, the MRGO ecosystem restoration plan will not re-evaluate those authorized measures.
<b>Plan Objectives</b>	
It is not a study objective or restoration target to restore the study area to a pre-MRGO hydrologic condition.	This cannot be achieved within due to authorized navigation and risk reduction protection projects and other factors.
The primary purpose of the plan is ecosystem restoration. Hurricane and storm damage risk reduction through the protection and restoration of natural features is an authorized goal of the study. The reduction of damages will not be monetarily quantified. This goal will be achieved through the restoration of habitat in areas identified as critical landscape features for storm surge risk reduction.	The implementation guidance says, “Alternative plans shall be formulated <i>for the purpose of ecosystem restoration</i> inclusive of the requirements set forth in Section 7013 of WRDA 2007.” Ecosystem restoration studies do not require the quantification of economic benefits. Benefits of landscape features to risk reduction are difficult to empirically quantify.
<b>Future Without Project Conditions</b>	
Restoration of the Lake Maurepas swamps is assumed to be part of the future without project conditions.	Swamp restoration in these areas is addressed through several authorized LCA and CWPPRA diversion projects.
<b>Period of Analysis</b>	
For comparison of alternatives, the total period of analysis is from 2012 to 2065.	The implementation phase is 2012 to 2015 (begins with the first PED year; concludes with first construction completion year). The 50-year period begins with the first year when benefits would be realized and is 2015 to 2065.
<b>Relationship to Violet Diversion Authority</b>	
Section 3083 of WRDA 2007 authorizes the design and implementation of a diversion at or near Violet, Louisiana, which is located within the study area. This project will be analyzed as a component of the MRGO Ecosystem Restoration Plan.	This study has identified that salinity is a key driver in the sustainability of the restoration of areas affected by the MRGO and the Lake Borgne ecosystem. Feasibility level investigations will be included, consistent with the Implementation Guidance for this study.
<b>Minimum Restoration Target</b>	
The minimum restoration targets were developed to include direct and indirect habitat impacts of the former navigation channel by habitat type. Impacts include construction, operation, and maintenance of the MRGO through 2008.	These targets were set to produce a plan that meets the requirements of the study authority and USACE requirements for completeness, effectiveness, efficiency, and acceptability.
<b>Measures</b>	
Maintenance will be performed on shoreline protection features.	Shoreline protection features require maintenance to sustain benefits over the period of analysis. Swamp, marsh, and ridge features would be adaptively managed, but analyses indicate that periodic maintenance is not required to sustain benefits.

Assumption	Rationale for the Assumption
Marsh restoration areas will include vegetative plantings but marsh nourishment areas will not.	Marsh nourishment is performed using a thin layer of sediment slurry over existing marsh so it is assumed that the existing marsh vegetation will survive.

**Recommended Plan.** Plan C was chosen as the FIP because it is the lowest cost alternative that meets all of the study objectives and provides a complete plan to restore the Lake Borgne ecosystem. The National Ecosystem Restoration account is best achieved by Plan C, because it meets all of the study objectives, reasonably maximizes benefits for the associated costs, includes key restoration features to restore and sustain the form and function of the Lake Borgne ecosystem, and fully addresses the study authority.

Plan C would restore necessary natural processes and significantly improve the areas affected by the navigation channel. It would produce 37,980 Annual Average Habitat Units (AAHUs) and restore and protect approximately 57,472 acres of habitat, including 14,123 acres of fresh and intermediate marsh; 32,511 acres of brackish marsh; 10,318 acres of cypress swamp; 466 acres of saline marsh; and 54 acres of ridge habitat. Plan C provides 71 miles of shoreline protection in Lake Borgne, along the MRGO, and in the Biloxi Marsh, including 5.8 miles of oyster reef restoration. Plan C is illustrated in Figure S-5.

Approximately 11,222 acres of the restoration and protection features would be located in the East Orleans Landbridge/Pearl River area and approximately 9,012 acres of restoration features would be located in the Biloxi Marsh area, which have been determined to be critical landscape features with respect to storm surge. Additionally, forested habitats have some risk reduction benefits.

Recommendations are divided into tiers by the level of uncertainty regarding conditions for ecological success and long-term sustainability, including the need for additional study.

- Tier 1 includes features that have been developed to a feasibility level of detail and can be implemented independent of a future freshwater diversion to the area. Tier 1 features are recommended for implementation under Section 7013(a)(4), subject to the identification of a non-Federal sponsor willing and able to provide all required items of local cooperation. Implementation of Tier 1 features will result in 2414 AAHU's. Tier 1 features also include a recreation feature with estimated annual recreation benefits of \$349,000.
- Tier 2 includes features with feasibility level detail that may be sustainable without the implementation of a freshwater diversion, depending upon further study and assessment of area salinity levels. If further analysis indicate that favorable conditions for ecological success and long term sustainability exist for these features, as defined in the adaptive management plan, the reporting officers will submit a report to the Secretary to approve proceeding with implementation under Section 7013(a)(4). Implementation of Tier 2 features will result in 5694 AAHU's. Tier 2 features also include a recreation feature with estimated annual recreation benefits of \$147,000.
- Tier 3 includes features that require further study under existing authorities provided by Section 7013(a)(3). These features include the following:
  - a. Further examination of Tier 3A features related the Violet Freshwater Diversion in accordance with authority provided by Section 3083 of WRDA 2007. The full

- benefits and costs of a freshwater diversion will be incorporated as a part of the continuing study of Tier 3 features under authorities provided by Section 7013(a)(3).
- b. Further study of additional features that are dependent on freshwater diversion, including features in Tier 2 which further analyses indicate are not sustainable without additional fresh water. Implementation of Tier 3B features, assuming favorably salinity levels, is projected to result in 29,872 AAHU's.

Figure 5. Ecosystem Restoration Features of the Recommended Plan



**Systems / Watershed Context.** System-wide problems and opportunities were used to identify and define more geographically specific problems and opportunities. The FIP includes multiple types of management measures to address factors contributing to ecosystem degradation. Public and agency coordination has assisted in the development of a system based plan that complements other restoration activities.

**Environmental Operating Principles.** Properly formulated ecosystem restoration projects should be consistent with USACE Environmental Operating Principles. The analysis included in the Mississippi River Gulf Outlet Ecosystem Restoration Project Feasibility Study report shows that

implementation of the recommended plan will have a substantial benefit to the ecosystem of the Mississippi River Gulf Outlet and Lake Borgne while balancing the existing use and function of the area resources and the environmental services they provide. Environmental Operating Principles are listed below for reference:

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

**Peer Review.** In accordance with EC 1165-2-409, all technical, engineering and scientific work underwent an open, dynamic and vigorous review process to ensure technical quality. This included Agency Technical Review (ATR) and a Corps Headquarters policy and legal review. All concerns of the ATR have been addressed and incorporated into the final report. Independent External Peer Review (IEPR) was completed for the draft Feasibility Report. Through this process, nineteen final panel comments were identified and six were flagged for high significance. All outstanding issues with the IEPR comments were resolved between the District and the IEPR panel.

## EXPECTED PROJECT PERFORMANCE

**Project Costs.** Based on 2012 price levels, the Project First Cost of the FIP is estimated at \$2.9 billion. The Project First Cost of Tiers 1 and 2 is estimated at \$1.3 billion and \$325 million, respectively. The Project First Cost of the Monitoring and Adaptive Management Plan (MAMP) is \$190 million, including costs for potential adaptive management actions. The Project First Cost of the MAMP for Tiers 1 and 2 are \$104 million and \$46 million, respectively. The operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs for the FIP is \$427 million. The OMRR&R costs for plan features in Tiers 1 and 2 are estimated at \$210 and \$18 million, respectively.

Table 4. Cost Summary

Table 4 Equivalent Annual Costs and Benefits	
<b>Investment Costs</b>	
Project First Costs	\$2,884,147,000
Interest During Construction	\$813,274,307
<b>Average Annual Costs</b>	
Interest and Amortization of Original Investment	\$161,460,127
OMRR&R	\$ 13,783,157
Total Average Annual Costs	\$175,243,284
Average Annual Benefits	\$37,980
Net Annual Benefits	\$31,930

Table 5. Apportionment of Project First Costs between Federal and Non-Federal Sponsors

Table 5. Project First Costs for FIP (In FY 2012 \$1,000)					
Cost Category	Cost	Contingency	Total	Federal Responsibility	Non-Federal Responsibility
<b>Lands And Damages</b>	\$75,888	\$23,172	<b>\$99,060</b>		<b>\$99,060</b>
<b>Relocations</b>	\$0	\$0	<b>\$0</b>		
<b>Fish &amp; Wildlife Facilities (Plantings)</b>	\$109,532	\$26,945	<b>\$136,477</b>	\$88,710	\$47,766
<b>Fish &amp; Wildlife Facilities Adaptive Management</b>	\$90,754	\$53,998	<b>\$144,752</b>	\$94,088	\$50,663
<b>Recreation Facilities</b>	\$3,566	\$877	<b>\$4,443</b>	\$2,221	\$2,221
<b>Beach Replenishment</b>	\$1,783,352	\$438,705	<b>\$2,222,056</b>	\$1,543,396	\$678,659
<b>Planning, Engineering &amp; Design (PED)</b>	\$78,675	\$19,354	<b>\$98,030</b>	\$63,719	\$34,310
<b>PED Adaptive Management</b>	\$22,063	\$13,128	<b>\$35,191</b>	\$22,874	\$12,316
<b>Construction Management</b>	\$107,894	\$26,542	<b>\$134,435</b>	\$87,382	\$47,052
<b>Construction Management (Adaptive Management)</b>	\$6,083	\$3,620	<b>\$9,703</b>	\$6,306	\$3,396
<b>Baseline Total Cost:</b>	<b>\$2,277,807</b>	<b>\$606,340</b>	<b>\$2,884,147</b>	<b>\$1,908,700</b>	<b>\$975,446</b>

**Project Implementation.** There is currently no identified non-Federal sponsor for the Construction phase. Cost-sharing for plan implementation is subject to the rules for ecosystem restoration projects established in Section 210 of WRDA 1996. Accordingly, the non-Federal share will be 35 percent of the implementation costs of Tiers 1 and 2. Recreation features would be cost shared 50%/50% with OMRR&R a local responsibility in accordance with the cost sharing established by WRDA 1986, as amended. Non-Federal sponsors are responsible for 100 percent of lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRD), and operation, maintenance, repair, rehabilitation, and replacement (OMRR&R). The value of LERRD is credited to the 35 percent share. An adaptive management and resource monitoring plan is included in the Feasibility Study Report. Monitoring will be performed by the Corps over time and the project features will be operated per the adaptive management plan.

**Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R).** As noted above, the non-Federal sponsor will be responsible for all operation, maintenance, repair, rehabilitation and replacement of both ecosystem restoration and recreation features constructed in conjunction with this project. The costs of annual maintenance of all project features total approximately \$14 million. Maintenance responsibilities are detailed within the cost estimate and generally include inspection, vegetation maintenance, road and bridge maintenance, and other repairs and rehabilitation as necessary.

**Key Social and Environmental Factors.** The continued coast wide decline of emergent wetlands would contribute to the deterioration of substrate upon which infrastructure features are constructed, leading to increased costs for maintenance and repair. These increased costs would be passed on to consumers. An increase in the cost of oil and natural gas infrastructure in Louisiana would likely increase nationally.

Hurricane storm damage risk reduction systems cannot fully depend on coastal landscape features because of the vulnerability of these features to single storm events. However, the FWOP condition could pose a hazard to the efficacy of the \$14.45 billion investment in risk reduction systems, because the buffer between the structural system and open water would continue to deteriorate.

The loss of wetlands would likely alter the detritus-based food web of the oyster, reducing the carrying capacity for oyster leases, resulting in a decline in oyster production. Because Louisiana and Western Mississippi Sound produce between 60 to 65 percent of the nation's oysters, these impacts would affect oyster availability and prices across the country.

Continued land loss would gradually change the estuarine system to a saltwater system. This change could have adverse impacts to estuarine fisheries, affecting the availability and cost of seafood nationally.

No significant adverse impacts are anticipated from the FIP. However, the adverse impacts of no action are significant to the region and Nation.

**Stakeholder Perspectives and Differences.** There were several major themes in the NEPA scoping comments: use sediment diversions and placement for wetland restoration; restore the area to a historical condition; restore the first line of storm surge defense; restore hydrology; and implement/incorporate existing plans.

The Draft Report was released to the public following a Notice of Availability (NOA) published in the Federal Register. Three Public Meetings provided an opportunity for participation in the planning process. The formal comment period began on December 17, 2010, and was extended twice upon request, resulting in a 78-day comment period. Comments fell into the following major themes:

- The plan is not extensive enough and/or should include additional specific measures. Additional oyster reef restoration in the Biloxi Marsh was the most frequent additional measure noted.
- Impacts of sediment sources should be considered carefully and/or Mississippi River sediment should be used.
- Support for the plan.
- Support for the implementation of the Violet Freshwater Diversion.
- Opposition to the proposed location of the Violet Freshwater Diversion.
- Impacts of the Violet Freshwater Diversion to water quality need to be monitored.
- The plan is important and implementation should be expedited.
- The plan needs to incorporate monitoring and adaptive management.
- The MRGO was destructive and/or contributes to storm damage.
- Alternative fuels should be utilized in construction of plan elements.
- The Central Wetlands should be restored.
- The plan should restore the outer areas of the project area and incorporate the multiple lines of defense concept.

The Final EIS for the study responds to all comments received.

**Environmental Compliance.** The Feasibility Study Report includes an Environmental Impact Statement. Issues of concern have been incorporated into the Environmental Impact Statement and all comments received during the review process have been responded to. A draft Record of Decision (ROD) is included in the report for future execution.

**State and Agency Review. [PLACEHOLDER – S&A REVIEW]** S&A review will begin on September 28, 2011 and end on October 28, 2011. Identify the states and agencies that responded, identify any objections or issues that they expressed, and summarize the final resolution of any objections or issues. (To be inserted by HQUSACE after the S&A Review ends.)

**Certification of Peer and Legal Review.** The Feasibility Study Report has undergone an open, dynamic, rigorous third party review at multiple stages of development. These reviews include Value Engineering (VE), Agency Technical Review (ATR), and Independent External Peer Review

(IEPR). All concerns of the ATR and legal review have been addressed and incorporated into the final report. All concerns of the IEPR and legal review have been addressed and incorporated into the final report.

**Policy Compliance Review.** [PLACEHOLDER] Summarize the final results of the HQUSACE policy compliance review process. (To be inserted by HQUSACE when the Documentation of Review Findings are completed.)