United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

November 21, 2012

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference Individual Environmental Report (IER #36) that is being prepared under the approval of the Council on Environmental Quality (CEQ) and that will partially fulfill the U.S. Army Corps of Engineers' (Corps) compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347). Individual Environmental Reports are CEQ-approved alternative arrangements for compliance with NEPA that would allow expedited implementation of improved hurricane protection measures. Work proposed under this programmatic IER would mitigate impacts resulting from the improved hurricane protection measures and would be conducted under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4). That law authorized the Corps to upgrade two existing hurricane protection projects (i.e., Westbank and Vicinity of New Orleans and Lake Pontchartrain and Vicinity) in the Greater New Orleans area in southeast Louisiana.

The Fish and Wildlife Service provides the enclosed draft report to assist your staff in fulfilling mitigation needs associated with those efforts in accordance with the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the FWCA. Furthermore, additional comments are provided in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.). Copies of this report have been provided to the National Marine Fisheries Service and the Louisiana Department of Wildlife and Fisheries and any comments they may have will be incorporated into our final report.

We will continue to work closely with your staff to ensure that fish and wildlife resources are conserved. Toward that end, please have your staff advise Mr. David Walther (337/291-3122) if you or your staff has any questions regarding this matter.

Sincerely,

Jeffrey D. Weller
Field Supervisor
Louisiana Ecological Services Office

cc: Fish and Wildlife Service, Atlanta, GA (AES)
Fish and Wildlife Service, Southeast Louisiana Refuge Complex, Lacombe, LA
National Marine Fisheries Service, Baton Rouge, LA
Environmental Protection Agency, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
LA, OCPR, Baton Rouge, LA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

November 21, 2012

Mr. Robert Barham
Secretary
Louisiana Department of Wildlife and Fisheries
Post Office Box 98000
Baton Rouge, Louisiana 70898-9000

Dear Mr. Barham:

Attached is the Draft Fish and Wildlife Coordination Act Report on the Individual Environmental Report (IER) 36, that is being prepared under the approval of the Council on Environmental Quality (CEQ) and that will partially fulfill the U.S. Army Corps of Engineers' (Corps) compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347). Work proposed under this programmatic IER would mitigate impacts resulting from the improved hurricane protection measures of the Lake Pontchartrain and Vicinity hurricane protection project and would be conducted under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4).

This report does not constitute the 2(b) report of the Fish and Wildlife Service (Service). The Service will incorporate your agency's comments into the final report prior to its submission to the Corps. Should your staff have any questions regarding this report, please have them contact David Walther (337/291-3122) of this office.

Your cooperation in this matter is appreciated.

Sincerely,

Jeffrey D. Weller
Field Supervisor
Louisiana Ecological Services Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

November 21, 2012

Mr. Richard Hartman
Branch Chief
Habitat Conservation Division
National Marine Fisheries Service
c/o Louisiana State University
Baton Rouge, Louisiana 70803-7535

Dear Mr. Hartman:

Attached is the Draft Fish and Wildlife Coordination Act Report on the Individual Environmental Report (IER) 36, that is being prepared under the approval of the Council on Environmental Quality (CEQ) and that will partially fulfill the U.S. Army Corps of Engineers' (Corps) compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347). Work proposed under this programmatic IER would mitigate impacts resulting from the improved hurricane protection measures of the Lake Pontchartrain and Vicinity hurricane protection project and would be conducted under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4).

This report does not constitute the 2(b) report of the Fish and Wildlife Service (Service). The Service will incorporate your agency's comments into the final report prior to its submission to the Corps. Should your staff have any questions regarding this report, please have them contact David Walther (337/291-3122) of this office.

Your cooperation in this matter is appreciated.

Sincerely,

Jeffrey D. Weller
Field Supervisor
Louisiana Ecological Services Office

Fish and Wildlife Coordination Act Report for the Hurricane and Storm Damage Risk Reduction System (HSDRRS), Lake Pontchartrain and Vicinity (LPV) Mitigation Project

PROVIDED TO
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY
ANGELA TRAHAN
FISH AND WILDLIFE BIOLOGIST

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
LAFAYETTE, LOUISIANA
NOVEMBER 2012

U.S. FISH AND WILDLIFE SERVICE – SOUTHEAST REGION

CORPS OF ENGINEERS

HURRICANE AND STORM DAMAGE RISK REDUCTION SYSTEM

LAKE PONTCHARTRAIN AND VICINITY

FISH AND WILDLIFE COORDINATION ACT REPORT

MITIGATION PLAN

Prepared by

Angela Trahan

U.S. Fish and Wildlife Service

Lafayette, Louisiana

Table of Contents

EXECUTIVE SUMMARY i
INTRODUCTION 1
DESCRIPTION OF THE STUDY AREA'S FISH AND WILDLIFE RESOURCES 2
Essential Fish Habitat 5
Endangered and Threatened Species 5
National Wildlife Refuges 10
PROJECT IMPACTS AND MITIGATION 11
ALTERNATIVE EVALUATION PROCESS 14
MITIGATION TENATIVELY SELECTED PLAN 16
ANTICIPATED BENEFITS FROM THE MITIGATION SITES 21
SERVICE POSITION AND RECOMMENDATIONS 22
LITERATURE CITED 25
Appendix A Summary of Basic Mitigation Land Requirements 1
Appendix B HSDRRS LPV IMPACTS 1
Appendix C Draft Borrow Design and General Marsh Creation Guidelines 1
Appendix D Final Array of Alternatives 1
Appendix E Project Information Sheets 1
Appendix F Corps' Restoration Guidelines Documents 1
Appendix G FWS Comments on Corps' Restoration Guidelines Documents 1
Appendix H September 13, 2012, Planning Aid Letter 1

EXECUTIVE SUMMARY

This Fish and Wildlife Coordination Act (FWCA) Report of the Fish and Wildlife Service (Service) documents changes in impacts being mitigated by the Corps of Engineers' (Corps) for activities associated with implementation of the Hurricane and Storm Damage Risk Reduction System (HSDRRS), Lake Pontchartrain and Vicinity (LPV) Project and addresses the mitigation plan for project-associated impacts to forested wetlands and estuarine marsh. Our findings and recommendations are presented in accordance with the FWCA (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and have been developed on the basis of surveys and analyses of project impacts and potential improvement of mitigation areas for fish and wildlife resources. This report does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of that Act. The Service has provided copies of this report to the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF), and their comments will be incorporated into the final report.

This report addresses the mitigation plan for the LPV hurricane protection project and incorporates and supplements our FWCA Reports that addressed pre-Hurricane Katrina impacts and mitigation features for the LPV project (dated July 25, 1984, January 17, 1992, and April 7, 2011). It also supplements our November 26, 2007, Draft FWCA Report that provided twenty-six programmatic recommendations for the HSDRRS authorized work to help avoid and minimize impacts to fisheries, wetlands, forested habitats, migratory birds, and public lands, and incorporates, and supplements the numerous FWCA Reports provided for the work authorized under 4th and 5th Supplemental for the LPV Hurricane Protection Project only (i.e., IERS 1-11, including supplemental documents). The Service also provided a September 13, 2012, Planning-aid letter supporting the implementation of the proposed mitigation measures for LPV impacts; this draft report reiterates our position regarding those measures. Impacts and mitigation needs resulting from government and contractor provided borrow areas have been addressed in an October 25, 2007, and a November 1, 2007, FWCA reports, respectively, therefore this report will not address those project features.

The Corps is continuing to refine the mitigation needs through the habitat assessments based on forthcoming as-built drawings of levee footprint impacts. Therefore initial acreages assessed in each habitat assessment project information sheet may not correlate with proposed acreages in the Tentatively Selected Plan (TSP). Further, mitigation site data is needed to refine design of the mitigation features to the 65% design level. Therefore, proposed mitigation feature footprints cannot be finalized at this time. Continued coordination with the interagency team is essential throughout the finalization of engineering and design of the mitigation features. Additional Service recommendations may be provided in supplemental reports as those plans are more fully developed.

Construction and implementation of the LPV hurricane protection project improvements resulted in approximately 1,239 acres [459 Average Annual Habitat Units (AAHUs)] of impacts to forested wetlands and estuarine and non-estuarine emergent marsh, some of which occurred on the Bayou Sauvage National Wildlife Refuge (NWR). Impacts resulted primarily from the expansion of levee right-of-way (ROW) and construction of levees, borrow pits, floodwalls, navigable floodgates, and associated features.

Through the Corps' alternative evaluation process (AEP) selection of the following TSP plan for mitigating impacts for the LPV hurricane protection project was determined:

- Milton Island Intermediate Marsh Restoration (non-refuge impacts)
- Mitigation Bank for BLH and Swamp Habitat (non-refuge impacts)
- Bayou Sauvage Flood-side Brackish Marsh Restoration (refuge and non-refuge impacts)
- Fritchie BLH Habitat (wet) Enhancement Project (refuge impacts)
- Bayou Sauvage Protected-side BLH Habitat Restoration (refuge impacts)
- Bayou Sauvage Protected-side Intermediate Marsh Restoration (refuge impacts).

Implementation of the TSP would restore a minimum of 823 acres of BLH habitat (604 acres/132 AAHUs for HSDRRS impacts and 219 acres/ 43 AAHUs for Task Force Guardian impacts), 187 acres (103 AAHUs) of swamp habitat, 148 acres (76 AAHUs) of intermediate marsh, and 262 acres (137 AAHUs) of brackish marsh. Of these restoration efforts, a minimum of 15 AAHUs of BLH, 41 AAHUs of intermediate marsh, and 9 AAHUs of brackish marsh would be mitigated on the Bayou Sauvage NWR to offset impacts to that refuge. Implementation of the proposed mitigation plans is predicted to improve and maintain the habitat value of the BLH, swamp and marsh habitat for fish and wildlife. Mitigation-area habitat values would increase due to the increased quantity and quality of mast-producing trees, and moderate increases in shrub and herbaceous cover after planting of forested areas and due to the creation of higher-quality vegetated estuarine habitats.

The Service supports the Corps' plan to mitigate impacts to fish and wildlife resources associated with LPV HSDRRS provided that the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation and outstanding issues are adequately resolved via ongoing planning efforts:

1. Avoid adverse impacts to bald eagle and osprey nesting locations and wading bird colonies through careful design project features and timing of construction. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

2. We recommend that the Corps initiate Endangered Species Act (ESA) consultation with this office to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their habitat. Subsequently, ESA consultation should be reinitiated should the proposed project features change significantly or are not implemented within one year of the last ESA consultation with this office to ensure that the proposed project does not adversely affect any federally listed threatened or endangered species or their habitat.

3. Impacts to wetland habitat (including submerged aquatic vegetation habitat) and non-wet BLH associated with the construction of the mitigation features should be avoided and minimized to the greatest extent possible. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet BLH caused

by project features preferably through resizing of the mitigation features and in close coordination with the natural resource agencies.

4. Impacts to Essential Fish Habitat (EFH) should be avoided and minimized to the greatest extent possible. For proposed project areas that impact designated EFH habitat, coordination with the NMFS should be conducted.

5. Sediment borrow sites for the marsh creation areas should be designed to avoid and minimize impacts to water quality. The general guidelines for borrow design is found in Appendix C should be incorporated into project design, and close coordination with the natural resource agencies should continue since borrow design can be case specific and influenced by a number of factors.

6. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, Water Control Plans, or other similar documents) should be coordinated with the Service, NMFS, LDWF, Environmental Protection Agency (EPA), and Louisiana Department of Natural Resources (LDNR). The Service shall be provided an opportunity to review and submit recommendations on the all work addressed in those reports.

7. If applicable, a General Plan should be developed by the Corps, the Service, and the managing natural resource agency in accordance with Section 3(b) of the FWCA for mitigation lands.

8. If mitigation lands are purchased for inclusion within a NWR those lands must meet certain requirements; a summary of some of those requirements is provided in Appendix A. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore, if they are proposed as a manager of a mitigation site they should be contacted early in the planning phase regarding such requirements.

9. The Corps should continue to coordinate with refuge personnel during planning and compatibility determination processes. A Special-Use Permit should be obtained prior to any entrance onto the refuge. Coordination should continue until construction of the flood protection project and restoration projects are complete and prior to any subsequent maintenance. Points of contacts for that refuge are Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Neil Lalonde (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR. The Corps should not sign the Decision of Record until a Compatibility Determination is complete.

10. The local sponsor should also be made aware of the above requirements should it be their responsibility to transfer mitigation lands to the Service or other land-managing natural resource agency.

11. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation and/or maintenance of mitigation lands, then the Corps should provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

12. Any proposed change in mitigation features or plans should be coordinated in advance with the Service, NMFS, LDWF, EPA and LDNR.

13. The Service encourages the Corps to finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction and revising the impact and mitigation period-of-analysis to reflect additional temporal losses will not be required.

14. For on-refuge impacts the Service prefers and recommends implementation of the proposed TSP, including the Bayou Sauvage brackish marsh alternative, because this alternative ranks higher in long-term sustainability and property management feasibility over other brackish marsh alternatives. Further, the Service does not support the selection of the Golden Triangle mitigation alternative for on-refuge impacts; however, we would not object to that alternative should it be selected for non-refuge impacts.

15. The Service supports the mitigation of on-refuge flood-side BLH impacts on either side of the levee (flood or protected) and recommends that the Corps, in consultation with the Service, develop acceptable mitigation for such impacts should the proposed tentatively selected plan mitigation feature (i.e., Fritchie alternative) not be feasible.

16. The habitat assessment for the Fritchie BLH alternative is based on a surrogate BLH habitat located in the vicinity of the project area. Once access is granted to the proposed restoration area, a reassessment should be conducted. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

17. The Service recommends that the Corps work with the natural resource agencies to incorporate proposed modifications (Appendix G) and finalize the "GUIDELINES – WET BLH HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT" and the untitled document for marsh mitigation (Appendix F).

18. The Service recommends that the Corps maintain full responsibility for any BLH mitigation project for a minimum of 4-years post planting. The Corps should maintain full responsibility for all marsh mitigation projects until monitoring guidelines to be developed are completed and demonstrate the projects are fully compliant with success and performance requirements.

19. At this time none of the mitigation planning documents describe in detail actions needed by the Corps and/or the local sponsor if mitigation is not succeeding as planned. The Service recommends that this important component of the mitigation plan be developed.

INTRODUCTION

This Fish and Wildlife Coordination Act (FWCA) Report of the Fish and Wildlife Service (Service) documents changes in impacts being mitigated by the Corps of Engineers' (Corps) for activities associated with implementation of the Hurricane and Storm Damage Risk Reduction System (HSDRRS), Lake Pontchartrain and Vicinity (LPV) Project and addresses the mitigation plan for project-associated impacts to forested wetlands and estuarine marsh. Our findings and recommendations are presented in accordance with the Fish and Wildlife Coordination Act (FWCA; 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and have been developed on the basis of surveys and analyses of project impacts and potential improvement of mitigation areas for fish and wildlife resources. This report does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of that Act. Furthermore, additional comments are provided in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.). The Service has provided copies of this report to the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF), and their comments will be incorporated into the final report.

Hurricane Katrina, a Category 3 storm, made landfall on the west bank of the Mississippi River and continued northeastward with the eye crossing Plaquemines, St. Bernard, Orleans and St. Tammany parishes in Louisiana. Hurricane surge inundated lower elevation areas in southeast Louisiana, and overtopped hurricane and flood control levees. As a result and under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (4th Supplemental) and Public Law 110-28, U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (5th Supplemental), the Corps is authorized to upgrade two existing hurricane protection projects [i.e., Westbank and Vicinity of New Orleans (WBV) and Lake Pontchartrain and Vicinity (LPV)] in the Greater New Orleans area. The Corps focus is on strengthening and improving the system that will provide a 100-year level of risk reduction for WBV and LPV projects that are capable of withstanding the effects of a storm having a 1% chance of occurring each year. The Corps is preparing Individual Environmental Reports (IER) under the approval of the Council on Environmental Quality (CEQ). Those IERs will partially fulfill the Corps compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347). IERs are a CEQ approved alternative arrangement for compliance with NEPA that has allowed expedited implementation of improved hurricane protection measures.

This report addresses the mitigation plan for the LPV hurricane protection project and incorporates and supplements our FWCA Reports that addressed pre-Hurricane Katrina impacts and mitigation features for the LPV project (dated July 25, 1984, January 17, 1992, and April 17, 2011). It also supplements our November 26, 2007, Draft FWCA Report that provided twenty-six programmatic recommendations for the HSDRRS authorized work to help avoid and minimize impacts to fisheries, wetlands, forested habitats, migratory birds, and public lands, and incorporates, and supplements the numerous FWCA Reports provided for the work authorized

under 4th and 5th Supplemental for the LPV Hurricane Protection Project only (i.e., IERS 1-11, including supplemental documents). The Service also provided a September 13, 2012, Planning-aid letter supporting the implementation of the proposed mitigation measures for LPV impacts; this draft report reiterates our position regarding those measures. Impacts and mitigation needs resulting from government and contractor provided borrow areas have been addressed in an October 25, 2007, and a November 1, 2007, FWCA reports, respectively, therefore this report will not address those project features.

The 4th and 5th Supplemental directed the Corps to proceed with engineering, design, modification, and construction, where necessary, of the LPV and the WBV Hurricane Protection Projects so those projects would provide 100-year hurricane protection. Construction and implementation of the LPV hurricane protection project improvements, thus far, has resulted in approximately 1,239 acres [459 average annual habitat units (AAHUs)] of impacts to forested wetlands and estuarine and non-estuarine emergent marsh, some of which occurred on the Bayou Sauvage National Wildlife Refuge (NWR). This includes IER 18 impacts associated with Meynard and Cummings borrow site impacts. As impact assessments continue to be refined, mitigation needs will be revised accordingly.

DESCRIPTION OF THE STUDY AREA'S FISH AND WILDLIFE RESOURCES

As previously mentioned, the Service has provided several FWCA Reports for the entire HSDRRS protection project. Those reports contain a thorough discussion of the significant fish and wildlife resources (including those habitats) that occur within the study area. For brevity, that discussion is incorporated by reference herein but the following brief descriptions are provided to update the previously mentioned information.

The study area is located within the Mississippi River Deltaic Plain of the Lower Mississippi River Ecosystem. Portions of Jefferson, Orleans, St. Charles, St. Bernard and Plaquemines Parishes are included in the study area. Higher elevations occur on the natural levees of the Mississippi River and its distributaries. Developed lands are primarily associated with natural levees, but extensive wetlands have been leveed and drained to accommodate residential, commercial, and agricultural development. Federal, State, and local levees have been installed for flood protection purposes, often with negative effects on adjacent wetlands. Navigation channels such as the Gulf Intracoastal Waterway (GIWW) and the Mississippi River – Gulf Outlet (MRGO) are also prominent landscape features, as are extensive oil and gas industry access channels and pipeline canals. Extensive wetlands and associated shallow open waters dominate the landscape outside the flood control levees. Major water bodies include Lake Pontchartrain located north of the project area, the Mississippi River which bisects the project area, Lake Borgne located on the eastern edge of the project area, and on a smaller scale Lake Lery located south of the Caernarvon Freshwater Diversion in St. Bernard and Plaquemines Parishes.

Habitat types in the project area include forested wetlands [i.e., bottomland hardwoods (BLH) and/or swamps], non-wet BLH, marsh, open water, and developed areas. Due to urban

development and a forced-drainage system, the hydrology of most of the forested habitat within the levee system has been altered. The forced-drainage system has been in operation for many years, and subsidence is evident throughout the areas enclosed by levees.

Wetlands (forested, marsh, and scrub-shrub) within the study area provide plant detritus to adjacent coastal waters and thereby contribute to the production of commercially and recreationally important fishes and shellfishes. Wetlands in the project area also provide valuable water quality functions such as reduction of excessive dissolved nutrient levels, filtering of waterborne contaminants, and removal of suspended sediment. In addition, coastal wetlands buffer storm surges reducing their damaging effect to man-made infrastructure within the coastal area.

Factors that will strongly influence future fish and wildlife resource conditions outside of the protection levees include freshwater input and loss of coastal wetlands. Depending upon the deterioration rate of marshes, the frequency of occasional short-term saltwater events may increase. Under that scenario, tidal action in the project area may increase gradually as the buffering effect of marshes is lost, and use of that area by estuarine-dependent fishes and shellfish tolerant of saltwater conditions would likely increase. Regardless of which of the above factors ultimately has the greatest influence, freshwater wetlands within and adjacent to the project area will probably experience losses due to development, subsidence, and erosion.

The ongoing loss of coastal Louisiana wetlands (approximately 1,149 square miles between 1956 and 2004; average loss rate of 24 square miles per year) was exacerbated by Hurricanes Katrina and Rita in 2005. Those hurricanes caused an initial loss of wetlands equivalent to 9 years (approximately 217 square miles) of mean annual losses (Barras 2007). Louisiana wetlands provide 26 percent of the seafood landed in the conterminous United States and over 5 million migratory waterfowl utilize those wetlands every year. In addition, those wetlands provide protection to coastal towns, cities and their infrastructure, as well as important infrastructure for the nation's oil and gas industry.

Non-wet BLH within the project area also provide habitat for wildlife resources. Between 1932 and 1984, the acreage of BLH in Louisiana declined by 45 percent (Rudis and Birdsey 1986). By 1970, Jefferson Parish was classified as entirely urban or non-forested in the U.S. Forest Service's forest inventory with most of this loss resulting from development within non-wet areas inside the hurricane protection levees. A large percentage of the original BLH within the Mississippi River floodplain in the Deltaic Plain are located within levees. However, losses of that habitat type are not regulated or mitigated with the exception of impacts resulting from Corps projects as required by Section 906(b) of the Water Resources Development Act of 1986 and Section 2036 (a) of the Water Resource Development Act of 2007.

Mammals known to occur in the project-area BLH and marsh habitats include mink, raccoon, swamp rabbit, nutria, river otter, and muskrat. Those habitats also support a variety of birds including herons, egrets, ibises, least bittern, rails, gallinules, neotropic cormorant, white pelican, pied-billed grebe, black-necked stilt, sandpipers, gulls, and terns. Forested and scrub-shrub habitats within the study area also provide habitat for many resident passerine birds and essential resting areas for many migratory songbirds including warblers, orioles, thrushes, vireos,

tanagers, grosbeaks, buntings, flycatchers, and cuckoos (Lowery 1974). Many of these and other passerine birds have undergone a decline in population primarily due to habitat loss.

Given the extent of development and drainage, waterfowl use within the hurricane protection system is likely minimal, except in the adjacent wetlands outside the levees. Swamps, fresh and intermediate marshes usually receive greater waterfowl utilization than brackish and saline marshes because they generally provide more waterfowl food.

The Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.) and the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) offer additional protection to many bird species within the project area including colonial nesting birds, osprey, and the bald eagle (*Haliaeetus leucocephalus*). We continue to recommend that a qualified biologist inspect proposed work sites for the presence of undocumented nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist work should not be conducted within 1,000 feet of the colony during the nesting season. On-site personnel should also be informed of the possible presence of nesting bald eagles and ospreys within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is located within 660 feet of the levee right-of-way (ROW) the Corps should completed an on-line evaluation (http://www.fws.gov/southeast/es/baldeagle) to determine potential disturbance to nesting bald eagles and any protective measures necessary. A copy of that evaluation should be provided to this office. If assistance is needed in completing the evaluation please contact this office.

Open water habitat in the study area consists of drainage canals; major waterways including the GIWW, MRGO, and Mississippi River; and Lakes Pontchartrain, Borgne and Lery. Drainage canals do not support significant fishery resources because of dense vegetation, poor water quality, and inadequate depth. Freshwater sport fishes present in the project area, but outside of the levees, include largemouth bass, crappie, bluegill, redear sunfish, warmouth, channel catfish, and blue catfish. Other fishes likely to be present include yellow bullhead, freshwater drum, bowfin, carp, buffalo, and gar. Estuarine-dependent fishes and shellfishes such as Atlantic croaker, red drum, spot, sand seatrout, spotted seatrout, southern flounder, Gulf menhaden, striped mullet, brown shrimp, white shrimp, and blue crab are found in the intermediate to saline marshes of Lakes Pontchartrain and Borgne and adjacent waterbodies.

Some of the waterbodies in the project area meet criteria for primary and secondary contact recreation and partially meets criteria for fish and wildlife propagation, while others do not meet the criteria for fish and wildlife propagation (LDEQ 2012). Causes determined by the Louisiana Department of Environmental Quality (LDEQ) for not fully meeting fish and wildlife propagation criteria include excessive nutrients, organic enrichment, low dissolved oxygen levels, flow and habitat alteration, pathogens and noxious aquatic plants. Indicated sources of those problems include hydromodification, habitat modification, recreational activities, and unspecified upstream sources. Municipal point sources, urban runoff, storm sewers, and onsite wastewater treatment systems are also known contributors to poor water quality in the area.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297) set forth a new mandate for NOAA's NMFS, regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. The Essential Fish Habitats (EFH) provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals of maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. Detailed information on Federally-managed fisheries and their EFH is provided in the 1999 generic amendment of the Fishery Management Plans (FMP) for the Gulf of Mexico prepared by the Gulf of Mexico FMC (GMFMC). The generic FMP subsequently was updated and revised in 2005 and became effective in January 2006 (70 FR 76216). NMFS administers EFH regulations. Categories of EFH in the project area include the estuarine waters and substrates of the MRGO channel. Estuarine categories include estuarine emergent wetlands and estuarine water column, mud, sand, and shell water bottoms, and rock substrates.

Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, gulf menhaden, striped mullet, white mullet , killifish, kingfish, pompano, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). Under future without project conditions there would be no change to EFH.

Endangered and Threatened Species

To aid the Corps in complying with their proactive consultation responsibilities under the Endangered Species Act (ESA), the Service provided a list of threatened and endangered species and their critical habitats within the coastal parishes of the New Orleans District in a June 22, 2011, electronic mail transmittal to the Corps. The Service provides the following additional guidance as it relates to the features of the Tentatively Selected Plan (TSP).

Proposed Sediment Borrow Sources in Lake Pontchartrain

The endangered West Indian manatee (*Trichechus manatus*) is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams. It also can be found less regularly in other Louisiana coastal areas, most likely while the average water temperature is warm. Based on data maintained by the Louisiana Natural Heritage Program (LNHP), over 80 percent of reported manatee sightings (1999-2011) in Louisiana have occurred from the months of June through December. Manatee occurrences in Louisiana appear to be increasing and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of southeastern Louisiana. Manatees may also infrequently be observed in the Mississippi River and coastal areas of southwestern

Louisiana. Cold weather and outbreaks of red tide may adversely affect these animals. However, human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution.

During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972 and the ESA of 1973. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable. All on-site personnel are responsible for observing water-related activities for the presence of manatee(s). We recommend the following to minimize potential impacts to manatees in areas of their potential presence:

- All work, equipment, and vessel operation should cease if a manatee is spotted within a 50-foot radius (buffer zone) of the active work area. Once the manatee has left the buffer zone on its own accord (manatees must not be herded or harassed into leaving), or after 30 minutes have passed without additional sightings of manatee(s) in the buffer zone, in-water work can resume under careful observation for manatee(s).

- If a manatee(s) is sighted in or near the project area, all vessels associated with the project should operate at "no wake/idle" speeds within the construction area and at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. Vessels should follow routes of deep water whenever possible.

- If used, siltation or turbidity barriers should be properly secured, made of material in which manatees cannot become entangled, and be monitored to avoid manatee entrapment or impeding their movement.

- Temporary signs concerning manatees should be posted prior to and during all in-water project activities and removed upon completion. Each vessel involved in construction activities should display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8½ " X 11" reading language similar to the following: "CAUTION BOATERS: MANATEE AREA/ IDLE SPEED IS REQUIRED IN CONSRUCTION AREA AND WHERE THERE IS LESS THAN FOUR FOOT BOTTOM CLEARANCE WHEN MANATEE IS PRESENT". A second temporary sign measuring 8½ " X 11" should be posted at a location prominently visible to all personnel engaged in water-related activities and should read language similar to the following: "CAUTION: MANATEE AREA/ EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION".

- Collisions with, injury to, or sightings of manatees should be immediately reported to the Service's Louisiana Ecological Services Office (337/291-3100) and the LDWF, Natural Heritage Program (225/765-2821). Please provide the nature of the call (i.e., report of an incident, manatee sighting, etc.); time of incident/sighting; and the approximate location, including the latitude and longitude coordinates, if possible.

Should a proposed action directly or indirectly affect the West Indian manatee, further consultation with this office will be necessary.

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine and marine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain Basin, the Pearl River System, and adjacent estuarine and marine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Gulf sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures and navigation projects that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and the NMFS published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. In Louisiana, the designation includes portions of the Pearl and Bogue Chitto Rivers and Lake Pontchartrain east of the Lake Pontchartrain Causeway, as well as Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne in their entirety. The primary constituent elements essential for the conservation of Gulf sturgeon, which should be considered when determining potential project impacts, are those habitat components that support feeding, resting, sheltering, reproduction, migration, and physical features necessary for maintaining the natural processes that support those habitat components. The primary constituent elements for Gulf sturgeon critical habitat include:

- abundant prey items within riverine habitats for larval and juvenile life stages, and within estuarine and marine habitats for juvenile, sub-adult, and adult life stages;

- riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay;

- riverine aggregation areas, also referred to as resting, holding and staging areas, used by adult, sub-adult, and/or juveniles, generally, but not always, located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during freshwater residency and possibly for osmoregulatory functions;

- a flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of freshwater discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment, including migration, breeding site selection, courtship, egg fertilization, resting, and staging; and necessary for maintaining spawning sites in suitable condition for egg attachment, egg sheltering, resting, and larvae staging;

- water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;

- sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and,

- safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by a permanent structure, or a dammed river that still allows for passage).

Further consultation with this office will be necessary if the proposed action may directly or indirectly affect the Gulf sturgeon.

Borrow for the Bayou Sauvage brackish marsh mitigation feature would be located within Lake Borgne, an area designated as Gulf sturgeon critical habitat, further consultation with the NMFS will be necessary. As part of the critical habitat designation, the Service and NMFS consultation responsibility was divided by project location and Federal action agency. In riverine waters, the Service is responsible for all consultations regarding Gulf sturgeon and critical habitat, while in marine waters the NMFS is responsible for consultation. For estuarine waters, the Service is responsible for consultations with the Department of Transportation (DOT), the Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG), and the Federal Emergency Management Agency (FEMA). All other Federal agencies should consult with the NMFS office (Dr. Stephania Bolden, 727/824-5312).

Bayou Sauvage Borrow Site

There are five species of federally listed threatened or endangered sea turtles that forage in the near shore waters, bays, and estuaries of Louisiana. The NMFS is responsible for aquatic marine threatened or endangered species that occur in the marine environment. Please contact Eric Hawk (727/824-5312) at the NMFS Regional Office in St. Petersburg, Florida, for information concerning those species in the marine environment.

Bonnet Carré Mississippi River Borrow Site Alternative

The pallid sturgeon (*Scaphirhynchus albus*) is an endangered, bottom-oriented, fish that inhabits large river systems from Montana to Louisiana. Within this range, pallid sturgeon tend to select main channel habitats in the Mississippi River and main channel areas with islands or sand bars

in the upper Missouri River. In Louisiana it occurs in the Atchafalaya and Mississippi Rivers, and below Lock and Dam Number 3 on the Red River (with known concentrations in the vicinity of the Old River Control Structure Complex). The pallid sturgeon is adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change. Many life history details and subsequent habitat requirements of this fish are not known. However, the pallid sturgeon is believed to utilize Louisiana riverine habitat during reproductive stages of its life cycle. Habitat loss through river channelization and dams has adversely affected this species throughout its range.

Entrainment issues associated with dredging operations in the Mississippi and Atchafalaya Rivers and through diversion structures off the Mississippi River are two potential effects that should be addressed in future planning studies and/or in analyzing current project effects. We recommend the following to minimize potential impacts to pallid sturgeon associated with dredging to ensure protection of the pallid sturgeon: (1) the cutterhead should remain completely buried in the bottom material during dredging operations. If pumping water through the cutterhead is necessary to dislodge material or to clean the pumps or cutterhead, etc., the pumping rate should be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increase; (2) during dredging, the pumping rates should be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom.

Should the proposed project directly or indirectly affect the pallid sturgeon or its habitat, further consultation with this office will be necessary.

In addition to the above, two species have recently been listed as candidate species for federal listing as a threatened or endangered species. Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions.

The red knot *(Calidris canutus rufa*), is a medium-sized shorebird about 9 to 11 inches in length with a proportionately small head, small eyes, short neck, and short legs. The black bill tapers steadily from a relatively thick base to a relatively fine tip; bill length is not much longer than head length. Legs are typically dark gray to black, but sometimes greenish in juveniles or older birds in non-breeding plumage. Non-breeding plumage is dusky gray above and whitish below. The red knot can be found in Louisiana during the winter months (generally October through March).

In the southeastern United States, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks. Observations along the Texas coast indicate that red knots forage on beaches, oyster reefs, and exposed bay bottoms and roost on high sand flats, reefs, and other sites protected from high tides. In wintering and migration habitats, red knots commonly forage on bivalves, gastropods, and crustaceans. Coquina clams (*Donax variabilis*), a frequent and often important food resource for red knots, are common along many gulf beaches. Major threats to this species along the Gulf of Mexico include the loss and degradation of habitat due to erosion and shoreline stabilization development, disturbance by humans and pets, and predation.

The Sprague's pipit (*Anthus spragueii*), is a candidate species for federal listing as a threatened or endangered species. Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions. Sprague's pipit is a small (4 to 6 inches in length) passerine bird with a plain buffy face, a large eye-ring, and buff and blackish streaking on the crown, nape, and under parts. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Migration and wintering ecology of this species is poorly known, but Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. Its use of an area is dependent upon habitat conditions. This species is a ground feeder and forages mainly on insects but will occasionally eat seeds.

There is currently no requirement under the ESA for consultation regarding project impacts on candidate species. In the interest of conserving the Sprague's pipit and the red knot, we encourage you to avoid project activities that would adversely affect this species or its habitat. Should it be federally listed as threatened or endangered in the future, however, further consultation on project impacts to this species could then be necessary.

National Wildlife Refuges

The Service's Bayou Sauvage NWR is located in the eastern portion of the project area and experienced impacts as a result of the HSDRRS hurricane protection improvements. The National Wildlife Refuge System Improvement Act of 1997 authorized that no new or expanded use of a refuge may be allowed unless it is first determined to be compatible. A compatibility determination is a written determination signed and dated by the Refuge Manager and Regional Refuge Chief, signifying that a proposed or existing use of a national wildlife refuge is a compatible use or is not a compatible use. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the NWR. A compatibility determination is only required when the Service has jurisdiction over the use. For example, proposed uses that deal exclusively with air space, navigable waters or overly refuges where another Federal agency has primary jurisdiction over the area, would not be subject to compatibility.

Federal agencies proposing a project that includes features on a NWR are encouraged to contact the Refuge Manager early in the planning process. The Refuge Manager will work with the project proponent to determine if the proposed project constitutes a "refuge use" subject to a compatibility determination. If the proposed project requires a compatibility determination, a concise description of the project (refuge use) including who, what, where, when, how and why will be needed to prepare the compatibility determination. In order to determine the anticipated impacts of use, the project proponent may be required to provide sufficient data and information sources to document any short-term, long-term, direct, indirect or cumulative impacts on refuge

resources. Compatibility determinations will include a public review and comment before issuing a final determination.

All construction or maintenance activities (e.g., surveys, land clearing, etc.) on a NWR will require the Corps to obtain a Special Use Permit from the Refuge Manager; furthermore, all activities on that NWR must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact Kenneth Litzenberger, Project Leader for the Service's Southeast NWR and Neil Lalonde, (985) 822-2000, Refuge Manager for the Bayou Sauvage National Wildlife Refuge for further information on compatibility of restoration features, and for assistance in obtaining a Special Use Permit. Close coordination by the Corps, Local Sponsor, and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

The Service continues to recommend and support the mitigation for impacts to public lands on public lands within the managing agencies jurisdiction. If mitigation lands are purchased for inclusion within a NWR, those lands must meet certain requirements; a summary of some of those requirements is provided in Appendix A. Coordination with the Service's Southeast Louisiana Refuge Complex should continue. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore if they are proposed as a manager of a mitigation site they should be contacted early in the planning phase regarding such requirements.

PROJECT IMPACTS AND MITIGATION

Project impacts resulted primarily from the expansion of levee ROW and construction of levees, borrow pits, floodwalls, navigable floodgates, and associated features. Because development is ongoing within the hurricane protection levees and Task Force Guardian (TFG) restored hurricane protection to pre-Hurricane Katrina levels, the Service has assumed that project-induced development is insignificant and that implementation of the HSDRRS project would not further induce development to areas not already developed or planned for development. Construction and implementation of the LPV hurricane protection project improvements resulted in approximately 1,239 acres (459 AAHUs) of impacts to forested wetlands and estuarine and non-estuarine emergent marsh (Appendix B), some of which occurred on the Bayou Sauvage NWR. Impacts to the Bayou Sauvage NWR as a result of the improvements include approximately 188 acres of BLH habitat, 86 acres of intermediate marsh habitat, and 25 acres of brackish marsh habitat. Acreages of impacts presented are those known to have occurred by the date of this report. Ongoing activities may result in additional impacts. In addition to impacts related to the construction of the HSDRRS project, impacts to fish and wildlife habitats during the construction of mitigation projects may occur. Impacts that would occur within the footprint of the mitigation feature have been evaluated in the Wetland Value Assessment (WVA) and the mitigation area will be reconfigured to offset those impacts. However, the location of access ROWs, staging areas, and borrow areas have not been finalized nor assessed by the resource agencies at this time.

Some direct project impacts were not quantifiable but occurred; such impacts included closure of estuarine organism migration routes during construction of IERs 1, 8 and 11 and reduced wildlife movement due to floodwall construction on IER 10. However, minimization measures were incorporated when feasible, such as placement of culverts to allow some limited water exchange and estuarine organism access at migration routes for IER 8 and 11 and construction of wildlife passages within the floodwall for IER 10.

FWCA reports and supplemental reports were provided as project designs changed or post-construction impacts were calculated. This report derives lost AAHUs from the latest impact acreage calculations utilizing Geographic Information System ROW data provided by the Corps and recent aerial photography. Because some construction activities are still ongoing, acreage and AAHUs may be revised in future FWCA reports. However, this report supplements all previously provided acreage and AAHU losses denoted in our previous reports.

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values impacted. For impacts that occurred entirely within the existing ROW (i.e., maintained, non-wet grassland) and/or impacted low quality non-wet or prevalent habitats (e.g., open water without aquatic vegetation, dry fields, etc.) the Service did not recommend mitigation as they are Category 4 Resources. Considering the high value of forested wetlands and marsh for fish and wildlife and the relative scarcity of that habitat type, those wetlands were designated as Resource Category 2, the mitigation goal for which is no net loss of in-kind habitat value. Degraded (i.e., non-wet) BLH forests and any wet pastures that were impacted were placed in Resource Category 3 due to their reduced value to wildlife, fisheries and lost/degraded fish and wildlife functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value. To ensure no net loss of in-kind habitat value the TSP includes the restoration and enhancement of BLH habitat and the restoration of marsh and swamp habitat.

Impacts to open water bottoms are anticipated as a result of borrow activities. Regardless of depth, open water bottoms with no submerged aquatic vegetation (SAVs) will remain a Category 4; impacts to those areas are discouraged, if feasible, and measures to minimize impacts to water quality from borrow sites should be incorporated. Appendix C provides general guidelines for borrow design; however, close coordination with the resource agencies should continue during the design of borrow sites. SAV beds are currently considered a Category 2, and lost functions and values should be replaced. However, because of the relatively low success rate of SAV replanting, mitigating in-kind may not be practicable. Potential impacts to any SAVs should first go through the mitigation sequencing of avoidance, minimization, and rectification, prior to compensation of impacts.

Because open water bottoms without SAVs are considered a Category 4 resource for our trust resources the Service does not recommend mitigation. However, some tidally-influenced waters are designated as EFH, and the conversion of that habitat to a non-tidal elevation would result on a loss of EFH. Should EFH be impacted, coordination with the NMFS is recommended as mitigation for impacts to these areas may be necessary.

Habitat Assessment

To quantify anticipated project impacts to fish and wildlife resources and benefits resulting from the proposed mitigation, the Service continues to use the WVA methodology. Habitat units fluctuate in response to changes in habitat quality, represented by the Habitat Suitability Index (HSI), and/or quantity (acres); those changes are predicted for various target years over the project life (i.e., 50 years), for future without-project and future with-project scenarios. Target years (TY) were selected for this analysis to capture the effects of important biological events. Values for model variables were obtained from site visits to the area, previous wetland assessments in similar habitats, communication with personnel knowledgeable about the study area and similar habitats, and review of aerial photographs and reports documenting fish and wildlife habitat conditions in the study area and similar habitats. For all the habitat assessments, the products of the resulting HSI values and acreage estimates were then summed and annualized for each habitat type to determine the AAHUs available. The net change (increase or decrease) in AAHUs under future with-project conditions, compared to future without-project conditions, provides a quantitative comparison of anticipated project impact/benefits in AAHUs. By dividing the AAHU by the proposed mitigation project acreage a management potential per acre is determined which can then be used to resize the project once mitigation needs are refined. Further explanation of how impacts/benefits are assessed with the WVA and an explanation of the assumptions affecting HSI values are available for review at the Service's Louisiana Ecological Services Office. Impact assessments and mitigation benefit assessments considered sea-level rise, subsidence, accretion, and historic marsh loss trends and were coordinated with other State and Federal agencies.

Government Furnished Borrow

Of the government furnished borrow sites approved for use in HSDRRS construction only the Maynard and Cummings borrow sites discussed in IER 18 have been utilized to date. The total impact for that site is 226 acres (68.8 AAHUs) of protected side BLH dry which would be mitigated with the other LPV HSDRRS impacts.

Task Force Guardian

The Corps established TFG immediately after Hurricane Katrina hit the Louisiana and Mississippi coasts. TFG's main mission was to repair and restore the HSDRRS to pre-Katrina conditions. With the emergency declaration by the President, NEPA compliance for emergency repairs was documented in 'after-the-fact' Environmental Assessment (EA) 433. The habitat impacts as a result of TFG construction occurred within similar reaches as the LPV HSDRRS construction. Upon review of the habitat impacts as a result of the LPV HSDRRS 100% design shapefiles additional TFG impacts were identified that require mitigation. Table 1 below presents the acres of habitat type and AAHUs by reach that were impacted. The impacts to reach LPV-146 have been documented in EA 433. The impacts to LPV-108 and 145 would be

documented in the supplemental to EA 433 entitled "U.S. Army Corps of Engineers Response to Hurricanes Katrina and Rita in Louisiana" that is currently being completed. All of these impacts will be mitigated along with and in addition to the HSDRRS impacts at the LPV HSDRRS mitigation sites.

HSDRRS activities are located in the Mississippi River Deltaic Plain. Habitats (BLH, swamp, and estuarine marshes) within this area have decreased because of urbanization, especially adjacent to the New Orleans metropolitan area, and conversion to agriculture along the adjacent natural river levees. Other factors contributing to the loss of those habitats include hydrologic alterations associated with navigation channels, isolation from historic riverine overbank flows by flood-control levees, oil and gas exploration, extraction and transportation activities, sea-level rise, and subsidence. Due to their value and scarcity, in-kind compensation for project-induced losses to forested wetland habitats would be implemented. Avoidance and minimization of impacts to wetlands and incorporation of environmental features, when feasible, into levee designs were Corps' planning objectives. Initial assessments assumed a worst-case-scenario in determining habitat impacts. Since those initial assessments impacts have been reduced by almost half as a result of implementing design techniques such as installing floodwalls and deep soil mixing.

Table 1: Additional TFG Impacts

	Protected Side	
TFG/LPV Reach	BLH Dry	
	Acres	AAHUs
108	16.65	8.96
145	122.00	30.85
146	79.92	2.98
Total	**218.57**	**42.79**

ALTERNATIVE EVALUATION PROCESS

Because HSDRRS impacts spanned several watersheds it was decided to accept mitigation for project impacts within the basins where impacts occurred. LPV impacts would be undertaken in the Lake Pontchartrain Basin. Criteria used to screen mitigation proposals were developed for each basin (i.e., WBV and LPV). Criteria common to both basins included:

- Compliance with Water Resources Development Acts, the Clean Water Act and associated regulations, Corps regulations and policies, and other applicable environmental laws
- Risk of encountering hazard, toxic, or radioactive wastes
- In-kind habitat replacement of lost AAHUs (per Corps guidance)
- Technically viable
- Must not be a project(s) that would occur under Future Without Mitigation Project

Conditions

- Must have independent utility (not dependent on the completion of other projects)
- Can be scaled to meet mitigation requirements
- No stand-alone BLH-Dry projects; BLH-Dry requirements will be mitigated contiguous with mitigation for another habitat types and can be mitigated either on the flood or protected side of a levee and can be mitigated via wet BLH (i.e., out-of-kind)
- No stand-alone marsh nourishment projects
- Wet BLH projects must be contiguous with an existing resource-managed area
- Flood-side mitigation projects must be part of project(s) that consist of multiple habitat types unless contiguous with another resource-managed area (i.e., mitigation bank, State or Federal managed area)
- Fresh marsh can be mitigated as either fresh or intermediate marsh

Specific screening criteria developed for the Lake Pontchartrain Basin to be used during the AEP that selected the final alternatives and the TSP include the following criteria:

LPV Mitigation Screening Criteria:

- Within LPV Mitigation Basin
- Mitigation Banks must have a perpetual conservation easement/servitude
- BLH-Dry, BLH-Wet, and Swamp mitigation must be part of projects that consist of at least 100 contiguous acres of forested habitat unless contiguous with a marsh mitigation project or another resource-managed area
- Must meet 100% of mitigation requirement by habitat type according to the following groupings unless contiguous with other proposed mitigation project as follows (FS = flood side; PS = protected side):
    - 100% non-refuge BLH-Dry FS + PS (cannot be stand-alone)
    - 100% non-refuge BLH-Wet FS + PS
    - 100% non-refuge Swamp FS + PS
    - 100% non-refuge Brackish Marsh FS + PS and 100% refuge Brackish Marsh FS
    - 100% non-refuge Fresh/Intermediate Marsh FS + PS
    - 100% refuge BLH-Wet PS
    - 100% refuge BLH-Wet FS
    - 100% refuge Fresh/Intermediate Marsh PS

Selection criteria vary widely depending on the problem, and can even vary within the umbrella of Civil Works. For the purposes of hurricane and storm damage risk reduction, the selection criteria considered of the following: 1) Risk & Reliability – uncertainty relative to achieving ecological success, is an adaptive management plan required, long-term sustainability of project benefits, self-sustainability of project once performance standards are met, risk of exposure to stressors/reliability and resiliency of design; 2) Environmental Factors – including impacts and benefits to the human and natural environment; 3) Time; and 4) Cost.

MITIGATION TENATIVELY SELECTED PLAN

Using the above-mentioned screening and selection criteria the project delivery team (PDT) evaluated the final array of alternatives (Appendix D), and through the alternative evaluation process selected the following TSP for mitigating impacts for the LPV hurricane protection project:

- Milton Island Intermediate Marsh Restoration (non-refuge impacts)
- Mitigation Bank for BLH and Swamp Habitat (non-refuge impacts)
- Bayou Sauvage Flood-side Brackish Marsh Restoration (refuge and non-refuge impacts)
- Fritchie BLH Habitat (wet) Enhancement Project (refuge impacts)
- Bayou Sauvage Protected-side BLH Habitat Restoration (refuge impacts)
- Bayou Sauvage Protected-side Intermediate Marsh Restoration (refuge impacts)

Should the mitigation bank alternatives not be feasible, the Corps has selected the Bonnet Carré BLH and swamp restoration projects as alternate mitigation features. Provided below is a brief synopsis of the currently proposed features. More detailed information on the project areas can be found in the draft project information sheets (Appendix E). Appendices to those documents are available for review at the Service's Louisiana Ecological Services Office. The Corps is continuing to refine the mitigation needs based on forthcoming as-built drawings of levee footprint impacts. Therefore initial acreages assessed in the project information sheets may not correlate with proposed acreages in the TSP. Further, mitigation site data is needed to refine design of the mitigation features to the 65% design level. Therefore, proposed mitigation feature footprints cannot be finalized at this time. Continued coordination with the interagency team is essential throughout the finalization of engineering and design of the mitigation features. Additional Service recommendations may be provided in supplemental reports as those plans are more fully developed.

Milton Island Intermediate Marsh Restoration

The Milton Island intermediate marsh restoration feature is located near Madisonville in St. Tammany Parish, Louisiana, along the north shore of Lake Pontchartrain. As proposed, a minimum of 113 acres of flood-side intermediate marsh would be restored to intertidal marsh elevations, and the natural lake rim would be reestablished. Approximately 800,000 cubic yards of borrow material would be obtained from Lake Pontchartrain. Wetland value assessments conducted by the Service have determined that this project would provide a mitigation potential of 0.41 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than that which was determined for the Fritchie and Labranche alternatives (0.34 AAHUs). Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Mitigation Bank Option

Under the TSP, the Corps would purchase BLH-Wet and Swamp mitigation bank credits in the LPV basin to mitigate 132 and 43 AAHUs of BLH-Wet/Dry impacts for HSDRRS (including borrow) and TFG impacts, respectively, and 103 AAHUs of swamp impacts. The particular bank(s) to be utilized is unknown at this time and would be selected through a Request for Qualifications/Request for Proposal process. Through this process any mitigation bank with a perpetual conservation servitude having the appropriate number and resource type of credits available to meet 100% of the need by habitat type could submit a proposal for selling credits.

Bayou Sauvage Flood-side Brackish Marsh Restoration (refuge and non-refuge impacts)

The Bayou Sauvage marsh restoration feature is located near the communities of Irish Bayou and Chef Menteur on the Bayou Sauvage NWR in Orleans Parish, Louisiana. As proposed, a minimum of 302 acres of flood-side brackish marsh within three open water area would be restored to intertidal marsh elevations. Retention to ensure vertical accretion would consist of earthen retention, shoreline protection, and the establishment and refurbishment of rock foreshore dike. Approximately 2.7 million cubic yards of borrow material would be obtained from Lake Pontchartrain. Finally, it is anticipated that the marsh footprint would be planted upon satisfactory settlement and dewatering of the marsh platform. Plugs of appropriate marsh vegetation would be planted over 100% of the marsh restoration acreage on 7-ft centers. Wetland value assessments conducted by the Service have determined that this project would provide a mitigation potential of 0.42 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than that which was determined for the Fritchie alternative (i.e., 0.38 AAHUs). Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Fritchie BLH Habitat (wet) Enhancement Project (refuge impacts)

The Fritchie BLH habitat enhancement feature is located on the north shore of Lake Pontchartrain east of Slidell in St. Tammany Parish, Louisiana, and immediately west of Louisiana Highway 90. As proposed, a minimum of 51 acres of existing BLH habitat would be enhanced on Prevost Island, a chenier ridge consisting of three small forested islands surrounded by the Fritchie Marsh complex. Fill or grade requirements are not anticipated, however, enhancement would consist of invasive species eradication and reforestation, where applicable. Invasive species eradication entails removal of undesirable vegetation, ringing of trees, and herbicide application. Healthy existing hardwood species will remain on site. Where eradication of invasive and nuisance plant species creates large "gaps" in the canopy, a plan for tree plantings including species, quantity, layout, and timing would be conducted as per guidelines approved by the natural resource agencies. Staging areas have not been established at this time. WVAs conducted by the Service have determined that this project would provide a mitigation potential of 0.20 AAHUs per acre. The habitat assessment was based on a surrogate BLH habitat located in the vicinity of the project area. Once access is granted to the proposed restoration

area, a reassessment should be conducted. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Bayou Sauvage Protected-side BLH Habitat Restoration (refuge impacts)

The Bayou Sauvage protected-side BLH habitat restoration feature is proposed in conjunction with the Bayou Sauvage protected-side intermediate marsh restoration feature and would mitigate impacts that have occurred on refuge lands. Both are located within an impounded area of the Bayou Sauvage NWR immediately north of the GIWW in Orleans Parish, Louisiana. As proposed, a minimum of 155 acres of BLH habitat would be created in the impounded, open water area. Dedicated dredge material would be obtained from Lake Borgne via hydraulic dredge and transported directly to the designated restoration sites via pipeline. Material would be confined within earthen dikes to achieve targeted elevations. Access for the dredge pipeline and equipment from Lake Borgne would be via the designated access corridors in both Lake Borgne and open waters within the Golden Triangle area. It is estimated that approximately 2,630,000 cubic yards of dredged material would be required for the construction of both the BLH habitat and intermediate marsh restoration features. WVAs conducted by the Service have determined that this project would provide a mitigation potential of 0.56 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than 0.51 AAHUs, provided the feature is resized to offset impacts. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Bayou Sauvage Protected-side Intermediate Marsh Restoration (refuge impacts)

The Bayou Sauvage intermediate marsh restoration feature is proposed in conjunction with the Bayou Sauvage BLH restoration feature and would mitigate impacts that have occurred on refuge lands. As proposed, a minimum of 142 acres of intermediate marsh would be restored in an impounded, open water area of Bayou Sauvage NWR, as discussed above. WVAs conducted by the Service have determined that this project would provide a mitigation potential of 0.29 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than 0.24 AAHUs, provided the feature is resized to offset impacts. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Bonnet Carré BLH (non-refuge impacts) Alternative to Mitigation Bank

The Bonnet Carré BLH habitat restoration feature is located within the Bonnet Carré Spillway in St. Charles Parish, Louisiana. It is estimated that a minimum of 152 acres of "wet" BLH habitat would be restored to offset impacts to both BLH "wet" and BLH "dry" (hydrologically-altered) habitats. The Service will accept BLH-wet habitat mitigation to offset BLH-dry habitat. As currently proposed, BLH habitat restoration would be constructed within the central and southern portions of the Bonnet Carré spillway. It is estimated that 810,000 cubic yards of material would

be dredged from Lake Pontchartrain at the north end of the Bonnet Carré spillway. Material will be placed within existing shallow open water areas to achieve target elevations. Existing ridges within the various project locations would be used to assist in retention of the dredged material. Ridges having an elevation higher than +3.0 feet, North American Vertical Datum of 1988 (NAVD88), would be degraded and that material would be placed within open water areas. The dredge material/fill would be transported via hydraulic dredge within existing water bodies or cleared land so as to minimize impacts to existing vegetation. WVAs conducted by the Service have determined that this project would provide a mitigation potential of 0.62 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than 0.57 AAHUs, provided the feature is resized to offset impacts. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

Bonnet Carré Swamp (non-refuge impacts) Alternative to Mitigation Bank

The Bonnet Carré swamp forest restoration feature is located within the Bonnet Carré Spillway in St. Charles Parish, Louisiana, and north of the proposed BLH habitat restoration feature. It is estimated that a minimum of 299 acres of primarily open water would be restored to swamp habitat through the placement of dedicated dredge material obtained from Lake Pontchartrain. Approximately 1,280,000 cubic yards of material will be dredged from Lake Pontchartrain. WVAs conducted by the Service have determined that this project would provide a mitigation potential of 0.36 AAHUs per acre. As the project is refined the mitigation potential may be adjusted. The Service would not be opposed to a project that would result in mitigation potential no lower than 0.31 AAHUs, provided the feature is resized to offset impacts. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

The goal of the mitigation plan is to provide for equal replacement of the habitat units lost due to re-construction of the hurricane/flood protection projects. The equal replacement compensation goal specifies that the gain of one habitat unit can be used to offset the loss of one habitat unit. Achieving this goal would re-establish, maintain and protect BLH and bald cypress forested habitats and intermediate and brackish marshes as species diverse, sustainable habitats by restoring/maintaining unique functions, values, and services. The objectives of the mitigation measures for the forested areas would be to establish and maintain a high diversity of native mast- and fruit-producing trees and shrubs, maximize herbaceous and shrub-layer canopy cover while maintaining a semi-mature to mature BLH timber stand. While the objective of the mitigation measures for the marsh restoration projects would be to establish a diversity of native marsh vegetation at elevations that support intertidal marsh functions for a time period no less than that of a natural marsh.

As mitigation plans are further refined, the Corps, Service, EPA, LDWF, and NMFS would need to evaluate the plans against the accrued and anticipated benefits and the effect of implementing the proposal on achievement of the mitigation plan goal. Any changes that would prevent the mitigation goal from being achieved would not be recommended for implementation.

Furthermore, the following activities are not permitted within a mitigation area for the life of the project:

1. Placing, filling, storing, or dumping of refuse, trash, vehicle bodies or parts, rubbish, debris, junk, waste, or other such items on the property.
2. Mechanized land clearing or deposition of soil, shell, rock or other fill on the property without prior request for approval, excluding the existing ROWs.
3. Cutting, removal or destruction of vegetation on the property except in accordance with the restoration plan.
4. Grazing of cattle or other livestock on the property that has been restored or enhanced.
5. Commercial, industrial, agricultural, or residential uses of the property.
6. No other human activities that result in the material degradation of habitat within the area shall occur.

However, it is understood that the mitigation plan shall not prohibit hunting, fishing, trapping, non-consumptive recreational pursuits and exploration and production of minerals. Exploration and production of minerals shall be conducted in accordance with all applicable laws and regulations. The Service acknowledges that such activities have the potential to reduce the ability of the area to achieve the mitigation goal, depending on the extent of the impacts to the mitigation wetlands.

Modification and finalization of the "GUIDELINES – WET BLH HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT" (Appendix F) is needed. This plan addresses restoration and enhancement techniques such as reforestation planting, Chinese tallow tree removal and control methods; monitoring guidelines, schedule and responsibilities; success criteria; and some remedial actions. The Service has provide recommendations to the tree species list and the percentages proposed for planting to ensure successful reforestation, while some modifications have been made some revisions are still needed (Appendix G). In our 2005 report the Service provided Chinese tallow tree removal and control methods for WBV mitigation, since that time the methodology has changed to improve the success of such efforts. These revised methods should be incorporated into the mitigation reforestation plan. The methodology proposed to determine reforestation and restoration of jurisdictional wetland success should be modified to more closely reflect those standards utilized by mitigation banks.

The Service's review of the above document revealed the replanting beyond achievement of the initial success criteria (i.e., 1 year post planting) would be undertaken by the local sponsor. This appears to transfer the Operations Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) to the local sponsor upon attainment of the initial success criteria. The Service recommends that the Corps maintain full responsibility for any mitigation project for a minimum of 4-years post planting. That would allow the 4-year success criteria to be evaluated, prior to turning operation and maintenance responsibilities over to the local sponsor. Based on our experience, it would be virtually impossible to reasonably forecast the likely future success of the mitigation project based solely on mitigation activities accomplished during year one. The second monitoring event, performed 4 years after the initial mitigation activities, would provide significantly more insight into the continued development, success, and effectiveness of the implemented features.

The Corps has been working with the Service and other natural resource agencies to develop marsh mitigation specifications; the Service recommends that necessary revisions and finalization of this document also be undertaken. To further ensure future success of the marsh mitigation projects the Corps should maintain full responsibility for all marsh mitigation projects until monitoring guidelines (to be developed) are completed and demonstrate the projects are fully compliant with success and performance requirements.

At this time none of the mitigation planning documents describe in detail actions needed by the Corps and/or the local sponsor if mitigation is not succeeding as planned. The Service recommends that this important component of the mitigation plan be immediately developed.

Mitigation alternatives have been developed by the Corps, natural resource agencies, non-governmental organizations, and the public but internal review of the final mitigation plan by the Corps is ongoing. The Service encourages the Corps to finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction and revising the impact and mitigation period-of-analysis to reflect additional temporal losses would not be required.

As detailed in our September 13, 2012, planning-aid letter (Appendix H), for on-refuge impacts the Service prefers and recommends implementation of the Bayou Sauvage brackish marsh alternative because this alternative ranks higher in long-term sustainability and property management feasibility over other brackish marsh alternatives. The Service does not support the selection of the Golden Triangle alternative. In addition, the Service supports the mitigation of on-refuge flood-side BLH impacts on either side of the levee (flood or protected) and recommends that the Corps in consultation with the Service quickly develop acceptable mitigation for such impacts.

ANTICIPATED BENEFITS FROM THE MITIGATION SITES

Implementation of the proposed mitigation plans is predicted to improve and maintain the habitat value of the BLH, swamp and marsh habitat for fish and wildlife. Mitigation-area habitat values would increase due to the increased quantity and quality of mast-producing trees, and moderate increases in shrub and herbaceous cover after planting of forested areas and due to the creation of higher-quality vegetated estuarine habitats. Changes by TY in the HSI's reflect predicted habitat conditions under future-with and without-management scenarios. The difference between future with-management and future without-management AAHU values expected to result from the above-described mitigation scenario reflect the expected net benefit of the management actions. By dividing the AAHU by the proposed mitigation project acreage a management potential per acre is determined. This value will allow the mitigation projects to be resized as final impact assessments are complete. The management potential for the proposed mitigation sites is provided in the preceding TSP section. Implementation of the TSP would restore a minimum of 823 acres of BLH habitat (604 acres/132 AAHUs for HSDRRS impacts and 219 acres/ 43 AAHUs for Task Force Guardian impacts), 187 acres (103 AAHUs) of swamp habitat, 148 acres (76 AAHUs) of intermediate marsh, and 262 acres (137 AAHUs) of brackish marsh. Of these restoration efforts, a minimum of 15 AAHUs of BLH, 41 AAHUs of intermediate marsh, and 9

AAHUs of brackish marsh would be mitigated on the Bayou Sauvage NWR to offset impacts to that refuge. If the TSP is implemented as proposed additional off-refuge impacts would also be mitigated on-refuge, improving fish and wildlife habitat on public lands.

SERVICE POSITION AND RECOMMENDATIONS

The Service supports the Corps' plan to mitigate impacts to fish and wildlife resources associated with LPV HSDRRS provided that the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation and outstanding issues are adequately resolved via ongoing planning efforts:

1. Avoid adverse impacts to bald eagle and osprey nesting locations and wading bird colonies through careful design project features and timing of construction. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

2. We recommend that the Corps initiate ESA consultation with this office to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their habitat. Subsequently, ESA consultation should be reinitiated should the proposed project features change significantly or are not implemented within one year of the last ESA consultation with this office to ensure that the proposed project does not adversely affect any federally listed threatened or endangered species or their habitat.

3. Impacts to wetland habitat (including SAV habitat) and non-wet BLH associated with the construction of the mitigation features should be avoided and minimized to the greatest extent possible. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet BLH caused by project features preferably through resizing of the mitigation features and in close coordination with the natural resource agencies.

4. Impacts to EFH should be avoided and minimized to the greatest extent possible. For proposed project areas that impact designated EFH habitat, coordination with the NMFS should be conducted.

5. Sediment borrow sites for the marsh creation areas should be designed to avoid and minimize impacts to water quality. The general guidelines for borrow design found in Appendix C should be incorporated into project design, and close coordination with the natural resource agencies should continue since borrow design can be case specific and influenced by a number of factors.

6. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, Water Control Plans, or other similar documents) should be coordinated with the Service, NMFS, LDWF, EPA and LDNR). The Service shall be provided an opportunity to review

and submit recommendations on the all work addressed in those reports.

7. If applicable, a General Plan should be developed by the Corps, the Service, and the managing natural resource agency in accordance with Section 3(b) of the FWCA for mitigation lands.

8. If mitigation lands are purchased for inclusion within a NWR those lands must meet certain requirements; a summary of some of those requirements is provided in Appendix A. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore, if they are proposed as a manager of a mitigation site they should be contacted early in the planning phase regarding such requirements.

9. The Corps should continue to coordinate with refuge personnel during planning and compatibility determination processes. A Special-Use Permit should be obtained prior to any entrance onto the refuge. Coordination should continue until construction of the flood protection project and restoration projects are complete and prior to any subsequent maintenance. Points of contacts for that refuge are Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Neil Lalonde (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR. The Corps should not sign the Decision of Record until a Compatibility Determination is complete.

10. The local sponsor should also be made aware of the above requirements should it be their responsibility to transfer mitigation lands to the Service or other land-managing natural resource agency.

11. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation and/or maintenance of mitigation lands, then the Corps should provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

12. Any proposed change in mitigation features or plans should be coordinated in advance with the Service, NMFS, LDWF, EPA and LDNR.

13. The Service encourages the Corps to finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction and revising the impact and mitigation period-of-analysis to reflect additional temporal losses will not be required.

14. For on-refuge impacts the Service prefers and recommends implementation of the proposed TSP, including the Bayou Sauvage brackish marsh alternative, because this alternative ranks higher in long-term sustainability and property management feasibility over other brackish marsh alternatives. Further, the Service does not support the selection of the Golden Triangle mitigation

alternative for on-refuge impacts; however, we would not object to that alternative should it be selected for non-refuge impacts.

15. The Service supports the mitigation of on-refuge flood-side BLH impacts on either side of the levee (flood or protected) and recommends that the Corps, in consultation with the Service, develop acceptable mitigation for such impacts should the proposed TSP mitigation feature (i.e., Fritchie alternative) not be feasible.

16. The habitat assessment for the Fritchie BLH alternative is based on a surrogate BLH habitat located in the vicinity of the project area. Once access is granted to the proposed restoration area, a reassessment should be conducted. Should further development of feature designs result in a lower mitigation potential, a supplemental FWCA report may be necessary.

17. The Service recommends that the Corps work with the natural resource agencies to incorporate proposed modifications (Appendix G) and finalize the "GUIDELINES – WET BLH HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT" and the untitled document for marsh mitigation (Appendix F).

18. The Service recommends that the Corps maintain full responsibility for any BLH mitigation project for a minimum of 4-years post planting. The Corps should maintain full responsibility for all marsh mitigation projects until monitoring guidelines to be developed are completed and demonstrate the projects are fully compliant with success and performance requirements.

19. At this time none of the mitigation planning documents describe in detail actions needed by the Corps and/or the local sponsor if mitigation is not succeeding as planned. The Service recommends that this important component of the mitigation plan be developed.

LITERATURE CITED

Barras, J.A. 2007. Land area changes in coastal Louisiana after Hurricanes Katrina and Rita, in Farris, G.S., Smith, G.J., Crane, Mp., Demas, C.R., Robbins, L.L., and Lavoie, D.L., eds. Science and the storms – The USGS response to the hurricanes of 2005: U.S. Geological Survey Circular 1306. http://pubs.usgs.gov/ circ/1306

Louisiana Department of Environmental Quality (LDEQ). Accessed November 15, 2012. <http://www.deq.louisiana.gov/portal/DIVISIONS/WaterPermits/WaterQualityAssessment/WaterQualityInventorySection305b.aspx>

Lowery, A.H. 1974. Louisiana birds. La. State Univ. Press. 651 pp.

Rudis, Victor A., and Birdsey, R. A. 1986. Forest Resources and Current Conditions in the Lower Mississippi Valley. Resour. Bull. SO-116. New Orleans, La: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 7 p.

Appendix A

Summary of Basic Mitigation Land Requirements before Land is Transferred to the Fish and Wildlife Service

The following represents a summary of basic mitigation land requirements before land is transferred over to the Service. This does not necessarily represent a comprehensive list, but does represent our best effort to identify all land requirements within reason.

1. For inclusion into the National Wildlife Refuge (NWR) system the lands must be located within a refuge's acquisition boundary.

2. The Service must be provided copies of any easements/agreements for right-of-way on the property especially as it pertains to maintenance of such right-of-way, frequency of maintenance and costs associated with that maintenance if the maintenance is to be performed by the landowner.

3. The area must be surveyed prior to acquisition by the United States or transfer to the Fish and Wildlife Service. The survey will be conducted by the Corps of Engineers (Corps) or an approved contractor. Boundaries must be marked and permanent monuments set at all corners. Copies of the surveyor notes, plats, etc. resulting from such survey must be provided to Service.

4. Language must be placed in the deed dedicating the mitigation land to fish and wildlife conservation in perpetuity.

5. When possible any restrictive covenants or liens shall be removed, especially if they could interfere with mitigation implementation, operation and/or maintenance.

6. Completion of a Level 1 survey for hazardous, toxic, and/or radioactive wastes with a copy being provided to the Service. If the Level 1 survey indicates the need for further investigations/surveys, those investigations/surveys must be completed and a copy provided to the Service. Lands having unremediated hazardous, toxic, and/or radioactive wastes present may not be accepted into a NWR. Remediated sites will be assessed for inclusion on a case-by-case basis. Documentation of the level of remediation is to be provided to the Service.

7. Funding mechanism for operation and maintenance of the mitigation lands and mitigation features (e.g., water control structures, timber stand improvements, etc.).

8. Documentation must be provided to the Service describing the mitigation goals and objectives in addition to a description of necessary operation and maintenance activities needed to accomplish the stated goals and objectives.

9. Mineral rights should be purchased. If it is not possible to purchase, then protection of surface rights via the following language:

"The vendors reserve for themselves, their successors and assigns, the right to explore, for, operate, produce, remove and transport, oil and gas from the lands herein described. The vendors reserve unto themselves, their successors and assigns, the right of ingress and egress over the said lands in pursuance of the reservations set forth above.

The land is now subject to oil and gas lease in favor of _____, as per lease of record in the records of _____, _____, pages _____ of Book _____, and the conveyance is subject to the rights of the lessee in said lease.

The oil and gas reservations made by the vendors herein in favor of themselves, their successors and assigns, shall be subject to the following stipulations, and any lease made by the vendors, their successors or assigns, subsequent to the date of this deed, shall contain the following stipulations for the protection of the vendee.

The vendors, their successors and assigns, agree that prior to entry upon the land for purposes of exploration, development or production of, oil and/or gas, they shall obtain a Special Use Permit from the U.S. Fish and Wildlife Service, which permit is for the purpose of providing for access and protecting the natural resources of the area for which the land was acquired, and whose terms and conditions will not unreasonably restrain the activities of the vendors, and their successors and assigns.

It is mutually understood between the parties that the intention of the Government in acquiring this area is to create a refuge for, and the protection of, wildlife in the area herein acquired, and the vendors will conform to, and be governed by, and the vendors herein bind themselves, their successors and assigns, agents and employees, to conform to, and be governed by, the rules and regulations pertaining to the protection of wildlife and refuge administration prescribed from time to time by the Secretary of the Interior or his/her authorized agent, the Director of Fish and Wildlife Service, except that such regulations shall not unreasonably restrain the exercise and use by the vendors, their successors and assigns, of the reservation set out in this agreement."

10. The Service would need a title commitment and policy in favor of United States of America that is in the American Land Title Association (ALTA) U.S. Policy 9/28/91 format as provided in Title Standards 2001.

If the title remains with the local-sharer or the Corps a General Plan as provided for under Section 3 of the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 et seq.) must be written. However, the Service may chose to not manage lands for which it does not have title.

Appendix B

HSDRRS LPV IMPACTS

NEPA Document[1]	Project/ Impacts		Swamp	Dry BLH	Wet BLH	Fresh Marsh	Intermediate Marsh	Brackish Marsh
IER 1	LPV	Acres	58.0					
	Temporary	AAHUs	20.1					
	LPV	Acres	128.7					
	Permanent	AAHUs	82.6					
IER 2	LPV	Acres						4.3
	Temporary	AAHUs						0.9
	LPV	Acres						25.9
	Permanent	AAHUs						13.1
IER 7 Non-Refuge	LPV	Acres			1.0		0.0	14.3
	Temporary	AAHUs			0.1		0.0	3.6
	LPV	Acres			28.4		3.3	13.4
	Permanent	AAHUs			14.5		1.2	11.5
IER 7 Refuge	LPV	Acres			15.9		7.3	14.8
	Temporary	AAHUs			2.1		0.2	3.8
	LPV	Acres			171.5		79.0	9.8
	Permanent	AAHUs			90.8		41.1	5.0
IER 9	LPV	Acres		2.1	0.1	0.6		
	Temporary	AAHUs		1.2	0.0	0.2		
	LPV	Acres		6.7	1.1	1.4		
	Permanent	AAHUs		1.1	0.7	0.1		
IER 10	LPV	Acres			20.5	1.1	5.9	
	Temporary	AAHUs			9.0	0.5	3.2	
	LPV	Acres		5.2	113.5	35.5	52.5	98.5
	Permanent	AAHUs		2.3	17.4	10.6	29.8	64.6
IER 11[2]	LPV	Acres		11.9				3.6
	Temporary	AAHUs		2.0				0.0
	LPV	Acres						77.1
	Permanent	AAHUs						34.7
IER 18[3]	Borrow	Acres		226.0				
	Permanent	AAHUs		68.8				
Totals	Non-Refuge	**Acres**	**186.7**	**251.9**	**164.6**	**38.6**	**61.7**	**237.1**
		AAHUs	**102.7**	**75.4**	**41.7**	**11.4**	**34.2**	**128.4**
	Refuge	**Acres**			**187.4**		**86.3**	**24.6**
		AAHUs			**14.6**		**41.3**	**8.8**

1) Includes all impacts (i.e., supplementals, tiers, and addendums) determined by the date of this report unless otherwise noted. However, TFG impacts are not included in this table but addressed in the report.
2) All temporary ROW impacts to brackish marsh resulted in permanent impacts thus they were included in the permanent AAHU totals.
3) Only Maynard and Cummings borrow sites were utilized thus impact acreage has decreased from FWCA Report.

Note: IERs 3, 4, 5, 6, and 8 did result in any quantifiable impact to any Service trust resources or their habitats, thus no compensation mitigation was recommended. IER 24 was a stockpile area that was cancelled prior to completion.

Appendix C

Draft Borrow Design and General Marsh Creation Guidelines

1. Fill elevations - settlement curves should be provided during PED
2. Access corridors across marsh should be backfilled prior to demobilization
3. Earthen Containment and Shoreline Protection (if any) constructed on marsh ultimately would need to be assessed in direct impacts.
4. Earthen Containment in open water - upland portions will not be credited as marsh
5. Degrading/Gapping plan would need to be development and should be tailored case specifically. The following is offered as a general design of dike gapping :

    A. If total dike degradation is not feasible, at a minimum, 1, 25-ft gap (bottom width) no less than every 1,000 ft, every 500 ft is preferred
    B. Depth of gap dependent on if it is in open water or on marsh,
    C. if on a high wave energy or protected energy shoreline:
        a. Open Water - should be to the pre-project water depth;
        b. Marsh - on both sides - should be to average marsh elevation
        c. If scour aprons are included, the bottom should be grubbed out so that the depth is measured tothe installed top of the armoring.
        d. Degraded material should be placed on adjacent remaining dikes and not marsh.

6. Spill boxes should be directed into adjacent deteriorating marsh to the greatest extend practicable.
7. Staging areas should be located to avoid and minimize impacts.
8. Borrow Impact Assessment - generically 2,000 ft from shore is sufficient to avoid inducing wave impacts. Further development with the interagency team should be conducted post 35% and AEP, but prior to finalization of the IERs.
9. Monitoring of dissolved oxygen and rate of infilling is recommended for the borrow site
10. Borrow Pit Design should be case specific but should also consider the following:
    A. Avoidance of sand to the maximum extent practicable
    B. Avoidance of submerged aquatic vegetation
    C. Avoidance of dredging to a depth resulting in change from a preferred substrate (i.e., sand) to a non-preferred substrate
    D. Avoidance of induced slope failure
    E. Avoidance of induced wave refraction/diffraction erosion of shoreline (by extension FWS and NMFS PRD may wish to apply that to critical habitat for Gulf sturgeon)
    F. Avoidance of pipelines
    G. Avoidance of inducing hypoxia – close coordination with the resource agencies is recommended as this is case specific and influenced by a number of factors such as water column stratification, current velocities and patterns, infilling rates, and urban discharge, etc. Other factors will need to be considered such as impacts to Gulf sturgeon critical habitat and SAVs.

Appendix D

Final Array of Alternatives

Non-Refuge BLH-Dry/BLH-Wet
Bonnet Carré Restore
Frenier Restore
Fritchie Restore/Enhance[2]
General Mitigation Bank (mitigate BLH-D with BLH-Wet)
Non-Refuge Swamp
Bonnet Carré Restore
Caernarvon Restore
La Branch Enhance
Milton Island Restore
General Mitigation Bank
Non-Refuge Intermediate Marsh
Bayou Des Mats Restore
Caernarvon Restore
Fritchie Restore[2]
Big Branch Restore[1]
La Branche Restore
Milton Island Restore
Non-Refuge/Refuge Brackish Marsh
Big Branch Restore[1]
Golden Triangle Restore
Fritchie Restore[2]
Bayou Sauvage Restore
Refuge PS BLH Wet
Bayou Sauvage Restore/Enhance
Refuge FS BLH-Wet
Fritchie Restore/Enhance[2]
Refuge PS Intermediate Marsh
Bayou Sauvage Restore

1. Area fluctuates between brackish and intermediate; captures both habitat types. Mitigates for refuge and general impacts.

2. Area fluctuates between brackish and intermediate; captures both marsh habitat types. Mitigates for refuge and general impacts. Compensates for Non-refuge BLH-W through restoration and enhancement, and refuge impacts through enhancement.

Appendix E

Draft Project Information Sheets

Wetland Value Assessment Project Information Sheet

November 9, 2012

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

Project Name: LPV HSDRRS Mitigation- Milton Island Marsh Creation

Mitigation Potential: 0.41 AAHUs/ acre

Project Type(s): Intermediate (408 acres) marsh restoration project

Project Area: The Milton Island marsh is located along the north shore of Lake Pontchartrain, west of the Tchefuncta River, in St. Tammany Parish.

Figure 1. Project Area

Project Goal: Restore approximately 408 acres of intermediate marsh habitat within the Milton Island Marsh project area. The proposed marsh site initial target elevation for dredge fill would be elevation +2.0' to +1.5' NAVD88, to ultimately hit a target marsh elevation of +1.0.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The coastal marsh WVA model consists of six variables: 1) percent of wetland area covered by emergent vegetation; 2) percent of open water area covered by aquatic vegetation; 3) marsh edge and interspersion; 4) percent of open water area $\leq$ 1.5 feet deep in relation to marsh surface; 5) salinity; and 6) aquatic organism access.

Values for those variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

V1 - Emergent Vegetation

Existing – The project area is mostly open water with 18 acres of marsh (i.e., 4%) present. Chabreck and Linscombe (1997) identified fresh marsh as occurring within the project area, while Sasser et al. (2007) classified the area as intermediate marsh.

The two major soil types in the project area are classified by Trahan (1987) as Allemands muck and Maurepas muck. Both soil types are very poorly drained, occurring within former freshwater marshes and swamps.

Land Loss Data

To calculate loss rates USGS evaluated a 9,848 acre extended boundary (Figure 2). USGS determined the 1985-2010 rate from a linear regression that is depicted in Figure 3. The loss rate (-0.25%/yr) was calculated from percent land values (acres) from that 1984-2010 timeframe. USGS excluded some data points from the regression analysis due to low and high water events.

USGS's percent is percent of the total area (marsh + water). The FWS percent is a percent of the 1985 land area. Typically, in WVAs and other such evaluations, we have used the FWS method as there might in some cases be non-wetlands within the polygon and then use of the total polygon area would result in obvious errors. Therefore, the FWS method has been the standard method used in the past. Based on the data provided by USGS, the FWS determined a loss rate of 0.28% per year. Applying this percentage to the project area polygon (area to be restored) it was determined that the area has a loss rate of 1.15 acres per year under the FWOP scenario. For FWP it is assumed that the loss rate would be reduced by 50%; and therefore, a loss rate of 0.57 acres per year was applied under the FWP scenario.

Figure: 2. USGS Extended Boundary for Milton Island Marsh - polygon 05

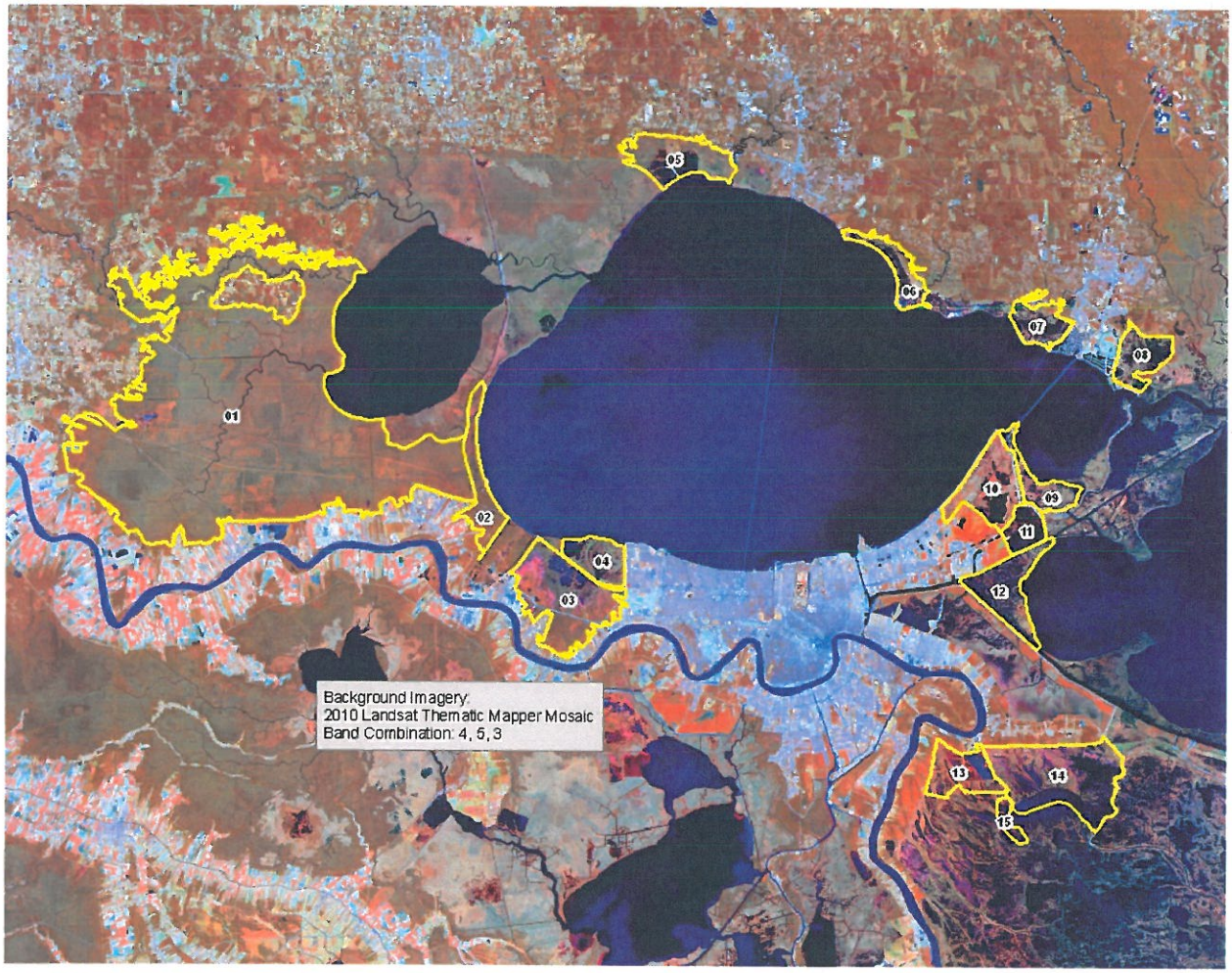
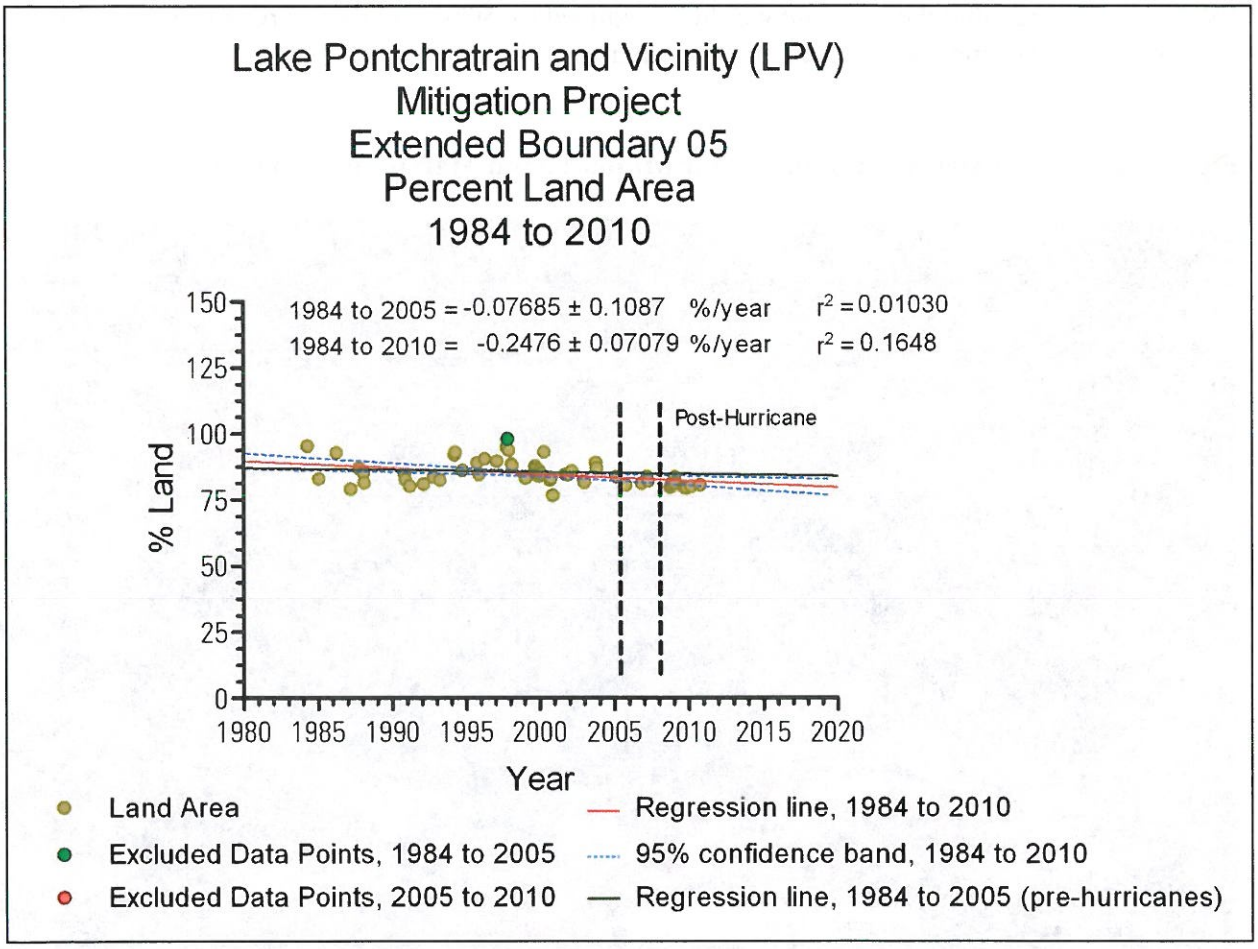


Figure 3. Land loss rate determined by USGS



FWOP

Loss Rate: -1.15 acres/year

TY0 Marsh 15 acres (4%) TY0 = 2013 (applied 3 years of loss to existing conditions)

	Water	393 acres (96%)
TY1	Marsh	14 acres (4%)
	Water	394 acres (96%)
TY3	Marsh	12 acres (3%)
	Water	396 acres (97%)
TY5	Marsh	10 acres (2%)
	Water	399 acres (98%)
TY6	Marsh	8 acres (2%)
	Water	400 acres (98%)
TY33	Marsh	0 acres (0%)
	Water	408 acres (100%)
TY50	Marsh	0 acres (0%)
	Water	408 acres (100%)

FWP

Created marsh platform has limited marsh function until settlement and breaching of retention dikes. Land loss is applied at the time of marsh creation. The rate is 50% of the background loss rate until TY33 when at least 10 inches of water is assumed to cover the marsh and background loss rate is resumed. Percent is of the entire project area acreage.

Loss Rate: -0.57 acres/year

TY0	Marsh	15 acres (4%)
	Water	393 acres (96%)
TY1	Marsh	41 acres (assume 10% credit of remaining marsh platform)
	Water	0 acres (0%)
TY3	Marsh	102 acres (assume 25% credit of remaining marsh platform)
	Water	1 acres (0%)
TY5	Marsh	406 acres (99% - assume all existing created marsh platform converted to marsh, therefore, full credit of remaining marsh platform)
	Water	2 acres (1%)
TY6	Marsh	405 acres (99%)
	Water	3 acres (1%)
TY33*	Marsh	383 acres (94%)
	Water	25 acres (6%)
TY50	Marsh	356 acres (87%)
	Water	53 acres (13%)

*The year at which the FWP loss rate returns to the background loss rate – see Milton FS Marsh Land Loss_jens working file_3.xlsx

V2 – Submerged Aquatic Vegetation

The project area is primarily open water with depths ranging from approximately 0.5 to 3 feet (see Milton Island Marsh Raw WVA Data.xlsx). During a May 17, 2011, HSDRRS WVA field trip it was estimated that approximately 55% of the open water had SAV cover. It is assumed that this value will decrease over the 50 year project life as open water areas continue to deepen

over time.

FWOP

TY0	55%	
TY1	55%	
TY3	55%	
TY5	55%	
TY6	55%	
TY33	35%	Assume decrease due to subsidence and continued deepening of open water
TY50	15%	Assume 70% decrease due to subsidence and continued deepening of open water

FWP

For the HSDRRS Mitigation alternatives analysis the interagency team developed the following assumptions for a 50 year project life:

TY0	55%
TY1	0%
TY3	0%
TY5	55% (baseline)
TY6	63% (increase baseline X 15%)
TY33	50% (assume decrease as open water areas deepen)
TY50	28% (decrease baseline X 50%)

V3 – Interspersion

The marsh creation cell has approximately 4% existing marsh (33/804 acres). For the HSDRRS Mitigation alternatives analysis it is assumed that marsh creation would occur within the entire cell and, therefore, no marsh nourishment would be credited. Therefore, the site will be classified as Class 5 for FWOP.

<u>Intermediate Marsh and Brackish</u>

FWOP

TY0	100% Class 5
TY1	100% Class 5
TY3	100% Class 5
TY5	100% Class 5
TY6	100% Class 5
TY40	100% Class 5
TY50	100% Class 5

FWP

The created marsh will be considered a "carpet marsh" at TY3 (i.e., 100% Class 3) transitioning to a Class 1 by TY6.

TY0	100% Class 5	
TY1	100% Class 5	
TY3	100% Class 3 ("carpet marsh")	
TY5	50% Class 3; 50% Class 1	
TY6	100% Class 1	
TY33	100% Class 1	
TY50	100% Class 2	Assume would drop to a Class 2 with 87% marsh and 13% water present at TY50

V4 – Shallow Open Water Habitat

Water depths were taken throughout the project site during a May 17, 2011 field investigation. Refer to Milton Island Marsh Raw WVA Data.xlsx for existing water depth and adjusted water depth information.

CRMS6209-H01 Average Water Elevation (ft NAVD88) - 1/2010-1/2011 = 0.74

Lake Pontchartrain at Mandeville (85575) 13:00 hours 4/14/2011 0.9 NAVD88

0.16 ft above average, therefore, subtract 0.16 to measured water depths to bring to average elevation

20% of the project area is currently ≤ 1.5 ft depth.

FWOP

TY0	20%	
TY1	20%	
TY3	20%	
TY5	20%	
TY6	20%	
TY33	15%	Assume decrease over time due to subsidence
TY50	5%	Assume decrease over time due to subsidence

FWP

TY0	20%	
TY1	100%	
TY3	100%	
TY5	100%	assume the 1% marsh lost would become shallow open water

TY6	100%	assume the 1% marsh lost would become shallow open water
TY33	90%	assume that marsh lost would convert to shallow open water and that shallow open water (i.e., ≤ 1.5 feet) would deepen over time (i.e., to > 1.5 feet)
TY50	83%	assume 1/6 of shallow open water (marsh loss) becomes deep based on 0.5 ft of subsidence

V5 – Salinity

Average salinity during the growing season information was obtained from the Guste Island Mitigation Bank (located east of Milton Island Marsh) project. It is not expected that the project will affect salinity because of the tidal exchange with adjacent Lake Pontchartrain.

FWOP & FWP

TY0	3.0 ppt
TY1	3.0 ppt
TY3	3.0 ppt
TY5	3.0 ppt
TY6	3.0 ppt
TY33	3.0 ppt
TY50	3.0 ppt

V6 – Fish Access

All of the study area is accessible and the access points are open and unobstructed.

<u>Intermediate Marsh and Brackish</u>

FWOP

TY0	1.0	open system
TY1	1.0	open system
TY3	1.0	open system
TY5	1.0	open system
TY6	1.0	open system
TY33	1.0	open system
TY50	1.0	open system

FWP

TY0	1.0	open system
TY1	0.0001	solid plug
TY3	0.0001	solid plug

TY5	1.0	open system
TY6	1.0	open system
TY40	1.0	open system
TY50	1.0	open system

Literature Cited

Chabreck, R. H. and G. Linscombe. 1997. Vegetation type map of the Louisiana coastal marshes. Baton Rouge, LA. Louisiana Department of Wildlife and Fisheries.

O'Neil, T. 1949. The muskrat in Louisiana coastal marshes: New Orleans, Louisiana Wildlife and Fisheries Commission, 28 p.

Sasser, C.E., J.M. Visser, E. Mouton, J. Linscombe, and S.B. Hartley. 2008. Vegetation types in coastal Louisiana in 2007: U.S. Geological Survey Open-File Report 2008–1224, 1 sheet, scale 1:550,000.

Trahan, Larry. 1990. Soil Conservation Service Soil Survey of St. Tammany Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. March 1990.

Wetland Value Assessment Project Information Sheet

October 2012

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

Project Name: LPV HSDRRS Mitigation- Bonnet Carré Site

***Mitigation Potential:** (old ~~0.39~~) 0.36 AAHUs/acre

Project Type(s): Swamp habitat reforestation and restoration

Project Area: The Bonnet Carré (BC) Spillway is located 20 river miles upstream from New Orleans near the town of Norco in St. Charles Parish, Louisiana. The BC Spillway is a feature of the Mississippi River flood control project and when in operation directs flood waters into Lake Pontchartrain.

Figure 1. Project Area

Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932 marsh was lost. However, there have been no significant habitat shifts in the Bonnet Carré Mapping Unit in the last 50 years proving it to be an area of sustainable habitat within an area of need. Since 1956, pockets of fresh marsh have developed in the unit and shoreline erosion is a detriment along the lake rim. While subsidence in the area is estimated at 1.1-2.0 ft/century, future land loss projections show no significant wetland loss in this unit over the next 50 years. Shoreline erosion is expected to continue along the lake (Coast 2050 Report- Appendix C 1999).

According to the Bonnet Carré Spillway Master Plan the estimated frequency of spillway operation is once every 10 years. In the 76 years the spillway has been available for use it has been opened nine times (during the floods of 1937, 1945, 1950, 1973, 1975, 1979, 1983, 1997, and 2008). All 350 bays were opened except in 1937, 1975, 1997, and 2008 when 285, 225, 298, and 160 bays were used, respectively. During the 1937 flood, the spillway was open for two months and lowered river stages at New Orleans by 3.5 feet. Dates and maximum flows for each opening are provided in the table below.

Table 1: Bonnet Carré Spillway Openings

Year	Dates of operation	Bays Open	Maximum Flow (cfs)
1937	28 Jan to 16 Mar	285	211,000
1945	23 Mar to 18 May	350	318,000
1950	10 Feb to 19 Mar	350	228,000
1973	8 Apr to 21 Jun	350	207,000
1975	14 Apr to 26 Apr	225	110,000
1979	17 Apr to 31 May	350	228,000
1983	20 May to 23 Jun	350	268,000
1997	17 Mar to 18 Apr	298	243,000
2008	11 April to 8 May	160	160,000

The St. Charles Parish Soil Survey classifies soils in the Bonnet Carré Spillway as Convent-Commerce soils which are level to gently undulating, somewhat poorly drained and are loamy throughout. Elevation ranges from 0 -15 feet above sea level. The soils are subject to scouring and deposition by fast flowing diversion waters. The convent and commerce soils correlate with the ridge and swale topography also described by Howard and Penfound (1942) as "Crevasse Topography" which is the deposit of sediments through a crevasse forming an extensive area of alternating ridges and swales. Convent soils are on the low ridges and are characterized as having a brown silt loam, fine sandy loam, and very fine sandy loam surface layer. The Commerce soils are in the swales between the ridges and are characterized as having dark brown silt loam or very fine sandy loam surface layer. The soils, if left undisturbed, are moderately well suited to the production of hardwood trees. Seeding mortality due to frequent flooding are noted in the soil survey as a concern in management (McDaniel 1987).

The amount of sediment deposited in the spillway varies with each opening and is estimated by using cross-sectional surveys. The 1973 flood deposited an estimated total of 12 million cubic yards (USACE 2009). It is estimated that with each opening, the river deposits an average of 9 million cubic yards of sediment, mostly silts and sand, within the floodway (Corps 2011).

Project Goal: Restore approximately # acres of swamp habitat within the Bonnet Carré Spillway. As currently proposed, swamp restoration mitigation would be constructed in the more northern part of the project boundary, identified in green on Sheet Identification "LPV BC". Restoration shall consist of the placement of dedicated dredge material, to be obtained from Lake Pontchartrain at the north end of the Bonnet Carré spillway, with placement of material to be concentrated within areas of existing shallow open water areas. Restoration would commence at the northern-most portion of the project area and proceed towards the river until the restoration of approximately 204 acres is completed. As the proposed targeted elevation for this habitat is within a range of +1.5 to +2.0 feet, the initial fill elevation shall be to an elevation of +3.0 feet to allow for subsidence and provide longevity of this desired habitat. Existing ridges will be used to assist in retention of the dredged material and ridges of elevation exceeding +2.5' will be degraded with the degraded material placed within the open water areas to be filled. Based off of available LIDAR data, and assumptions of existing conditions within the pits, it is estimated that approximately 990,000 cys would be required to complete this feature. The dredge material/fill would be transported via hydraulic dredge and the discharge pipeline run through under the I-10 and railroad trestles, and thence within existing water bodies or cleared land so as to minimize impacts to existing vegetation. Upon completion of placement of fill, the project would monitored, and at the appropriate time planted. Some hydrologic improvements may be required to encourage alternating wet/dry periods within the site and flowing water through the site. Reforestation activities should occur after high water season to allow growing period.

The target restoration area would be refined based on the AAHUs per acre generated by the WVA. Currently, the requirement is to mitigate approximately 108.01 aahus of Swamp habitat.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for swamp habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V_1 - Stand Structure

Existing –

Bonnet Carré Spillway Master Plan 3-4:

Approximately 40 percent of the spillway is forested. Two major forested types and two non-forested vegetation types are recognized in the spillway. The total forested area in the Bonnet Carré Spillway is approximately 3,020 acres, or 40 percent of the total spillway acreage. The vast majority of these forested areas (approximately 2,780 acres, or 92 percent of the total) are located between U.S. 61 and Lake Pontchartrain.

The swamps in the spillway are located in the lower elevations near Lake Pontchartrain. They have a firm substrate in comparison to swamps outside the guide levees. This is due to the deposition of alluvium from each spillway operation. Dominant trees and shrubs include baldcypress, tupelo gum, Drummond red maple, Carolina ash (*Fraxinus caroliniana*), pumpkin ash (*Fraxinus profunda*), palmetto, eastern baccharis, rattlebox (*Sesbania punicea*), buttonbush (*Cephalanthus occidentalis*), overcup oak, swamp-privet (*Foresteria acuminata*), waxmyrtle (*Morella cerifera*), black willow and waterelm (*Planera aquatica*). Common herbaceous and vines species include alligatorweed (*Alternanthera philoxeroides*), smartweeds, pennyworts (*Hydrocotyle* spp.), climbing hempweed, creeping spilanthes (*Spilanthes americana*), broadleaf panicum (*Panicum deustum*), frogfruit (*Phyla lanceolata*), and numerous grasses, rushes, and sedges.

Aquatic Vegetation in Canals and Ponds. Many various size canals and ponds are located within the spillway. Most of these are shallow and are filled with aquatic vegetation, while others are deeper and exhibit open water. Emersed, floating and submersed plants in these waterbodies include water hyacinth (*Eichhornia* spp.), delta duckpotato (*Sagittaria platyphylla*), duckweeds (*Lemna* spp.), alligatorweed, water pennywort (*Hydrocotyle bonariensis*), mosquito fern (*Azolla* spp.), sedges and rushes (*Carex* spp.), *Cyperus* spp., *Juncus* spp., floating waterprimrose (*Ludwigia peploides*), and pickerelweed (*Pontederia rotundifolia*).

Disturbed Areas. These areas have been modified to a great extent by man. Land clearing for the spillway eliminated bottomland hardwood and baldcypress-tupleo gum swamp forests. Different plant communities may be found in these disturbed areas following each operation of the spillway. Sand-loving colonizers become established on dunes formed from deposition of river alluvium. Perennial herbs are more common in the disturbed areas following successional trends after several years without a spillway operation. A variety of plants may be found in these disturbed areas. Common species are carpetweed (*Mollugo*spp.), southern waterhemp (*Amaranthus* sp.), pigweed (*Amaranthus* spp.), mock bishopweed (*Ptilimnium macrospermum*), ragweed (*Ambrosia* spp.), asters, spiny thistle (*Cirsium horridulum*), yankeeweed (*Eupatorium compositifolium*), goldenrod (*Solidago* spp.), cocklebur (*Xanthium* spp.), peppergrass (*Lepidium* spp.), morning glories (*Ipomra* spp), wolly croton (*Croton capitatus*), coffeeweed (*Sesbania* spp.), clovers (unknown), polly-prin (*Polypremum procumbens*), ironweed (*Vernonia* spp.), evening primroses (*Oenothera biennis*), wood sorrel (Oxalis spp.), bushy beardgrass (*Andropogon glomeratus*), Bermuda grass (*Cynodon dactylon*), Dallis grass (*Paspalum dilatatum*), smartweeds, buttercups (*Ranunculus* spp.), bedstraw (*Galium* spp.), vervain (*Verbena* spp.), peppervine, and numerous grasses, rushes and sedges. These disturbed areas have a rich and diversified flora.

The project area is located within the non-forested area of the Bonnet Carré known as the French Cut. This area has been degraded by past clay excavation activities. All of the historic bald cypress in this northern portion close to the lake has been killed, likely as a result of increased salinities.

FWOP – The BC Master Plan indicates that areas not mowed will be cleared of willows, but vegetation through natural colonization of volunteers will be allowed unless otherwise managed for recreation or wildlife. Because of the disturbed topography (primarily described as ponds and sand ridges) early successional species, e.g. perennial herbs and occasionally willow, will continue to proliferate in the project area. Overstory canopy closure will not be achieved within the life of the 57-year project life for FWOP.

- TY 0 – 50: Class 1

FWP –
Land shaping/grading would be required to restore surface grades to elevations that would support forested habitat (2-3 feet elevation for BLHwet, 1.5-2 feet elevation for swamp) and to allow for natural hydrologic patterns to occur. Tidal signatures are observed inland to Airline Highway. Also, during easterly driven high tides and storm tides the project area is inundated with several feet of water (Brantley 2011). Although projected Relative Sea Level Rise (RSLR) estimates (Appendix) predict that a sea-level rise of 2.0 feet is projected for the year 2063 under the Intermediate RSLR scenario, sediment input from spillway openings should keep up with those estimates. Some hydrologic affects may be evident by the end of the project life. An average of 9 million cubic yards of sediment, mostly silts and sand, is deposited within the

floodway with each opening, and openings occur on average every 10 years.

The St. Charles Soil Survey indicates that the mapping unit is well suited for water/flood tolerant tree species. Planting of flood tolerant species (e.g. baldcypress trees, green ash, and tupleo) would be on by 9-foot x 9-foot centers (538/acre) and mid-story species (e.g. buttonbush) on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallowtrees. Planting rates will consist of approximately 70-75 % bald cypress, 15-20 % tupelo, 10 % Drummond red maple, 10 % green ash, and 5 % buttonbush. Initially, herbaceous vegetation will dominate. Seedling replanting and noxious species control will be conducted to ensure future density. Assumptions are based on the 3 March 2012 WVA guidance document. At TY50 maintained a Class 6 due to influence of the spillway, potential increase in the use of the spillway, and closure of MRGO. The site may begin to experience some increased salinity affects as a result of increased sea-level rise by TY 50 but stand structure & maturity has likely not been affected.

- TY0-2: Class 1
- TY 3: Class 2
- TY 15: Class 6
- TY 35: Class 6
- TY 50: Class 6

Variable V_2 - Stand Maturity

Existing Conditions – Because of the disturbed nature of the area, there is little to no potential for the area to mature within the project life.

FWOP –
TY 0 – 57 – DBH < 1, BA<40 sq. ft.

FWP – Planting rates will consist of approximately 70-75 % bald cypress, 15-20 % tupelo, 10 % Drummond red maple, 10 % green ash, and 5 % buttonbush.

DBH assumptions from the 3 March 2012 version of the WVA model assumption guidance document were used. The "2011_BLH_Site-Ingrowth_Final" spreadsheet was used to determine basal area using a growth correction factor of -0.1, and 0.3, for cypress and tupelo, respectively.

TY	Tree Survival Rate/Stand Density	Cypress			Tupelo et al			Total BA
		(70%)	DBH	BA	(30%)	DBH	BA	
*2	538 – initial planting	377	0.2	1	161	0.3	1	2
*3	50% (538) = 269	188	0.2	1	81	0.5	1	2
*4	48% (538) = 258	181	0.6	1	77	0.8	1	2
15	40% (538) = 215	151	3.5	10.1	65	4.1	6.0	16.1
35	30% (538) = 161	113	8.2	41.4	48	9.6	24.1	65.5
50	30% (538) = 161	113	11.9	87.3	48	14.0	51.3	138.6

*the WVA spreadsheet does not allow values < 1 for DBH.

Variable V_3 - Water Regime

Existing

The French Cut area has been degraded by past clay excavation activities and many various size canals and ponds are located within the spillway. During excavation activities sands were side cast creating sand ridges around excavated ponds. Ponds are connected and gaps and culverts allow some limited exchange with canals. Tidal signatures are observed inland to Airline Highway. Also, during easterly driven high tides and storm tides the project area is inundated with several feet of water providing input of nutrients and dissolved oxygen. Although projected RSLR estimates predict that a sea-level rise of 2.0 feet is projected for the year 2063 under the Intermediate RSLR scenario (Appendix), sediment input from spillway openings are expected to keep up with total SLR. Therefore, spillway lands should not experience increased hydrologic conditions.

The Bonnet Carré Spillway Structure has been opened 9 times in its 80 years of existence (construction was complete in 1931)*. During the high water season on the Mississippi River (*e.g.,* late winter through spring), floodwaters leak between the timber needles and enter the floodway. The volume of this leakage can range from 100 cubic feet per second (cfs) to as much as 9,000 cfs, and the flow can last for several weeks to several months. Some years there is very little or no leakage through the structure and the effects are negligible in the floodway. This introduction of fresh water simulates the natural cycle of overbank flooding and provides numerous benefits to the aquatic and terrestrial resources in the spillway. These benefits include improved water circulation in the spillway's water bodies, nutrient introduction which provides short- and long-term benefits to the ecosystem, and restocking of fishery resources. Leakage events probably serve to scour entry channels from the lake enabling estuarine species to enter and complete life cycles in this vital nursery area. The flooding which results from these leakage events, although not as significant as spillway openings, occurs approximately every other year (Corps 2009).

FWOP- Existing conditions will persist. On average, approximately every other year during high water events (late winter –spring) the floodway will experience overbank flooding ranging in volume between 100 - 9,000 cfs. The project area will continue to experience seasonal and storm driven tidal exchange that will inundate the area.

FWP- Project area elevations will be restored to a more natural topography improving surface hydrologic conditions through rain rainfall and tidal input. The project area will continue to experience overbank flooding approximately every other year during high water events (late winter –spring).

Table 2: Projected FWP and FWOP Hydrologic Conditions

		Flooding Duration	Flow/Exchange	SI
FWOP		Permanent	Moderate	0.45
FWP	**TY 1**	Permanent	None	0.0
	TY 2-35	Seasonal	Moderate	0.85
	TY 50	Semi-Permanent	Moderate	

Variable V4-Mean High Salinity during the growing season.

Table 1. Mean salinities during the growing season.		Salinity	
CRMS Station	**Habitat**	**2009**	**2010**
6299	**Saline Marsh** -Labranche Wetlands along shoreline	5.05 ppt	2.07 ppt
0056	**Swamp** - Maurepas LB, inside RR	2.13 ppt	0.92 ppt
2830	**Intermediate Marsh** –Lebranche Wetlands NE of RR and I-10	4.62 ppt	1.94 ppt

CRMS station 0056 is within a swamp habitat south of the railroad and influenced by freshwater runoff from the Lake Mauepas watershed. The BC spillway swamp restoration site is also inland and at higher elevations than the marshes of the Labranche wetlands (CRMS sites 6299 and 2830). The site will receive freshwater input on occasion and elevations should be maintained throughout the project life. Therefore salinities from CRMS station 0056 are used for this analysis. Because of the influence of the MS River, future with and future without project conditions are not expected to be different, and as mentioned above, although projected RSLR estimates predict that a sea-level rise of 2.0 feet is projected for the year 2063 (Appendix) under the intermediate RSLR scenario, sediment input from spillway openings are expected to keep up with that rate. Therefore, spillway lands should not experience significant increased salinities within the project life.

FWOP & FWP -
2.13 + 0.92 = 3.05 ppt/2 = 1.51 ppt

Literature Cited

Brantley, 2011. Personal communication with Mr. Chris Brantley, Bonnet Carré Spillway manager. February 8, 2011.

Howard, J.A. and W.T. Penfound. 1942. Vegetational Studies in Areas of sedimentation in the Bonnet Carré Floodway. Bulletin Torrey Botanical Club 69:281-289.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

McDaniel, Donald. 1987. Soil Conservation Service Soil Survey of St. Charles Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

Montz, G.N. 1978. Vegetational Studies on the Effects of the 1973 Operation of the Bonnet Carré Spillway in Louisiana. Proceedings of the Louisiana Academy of Sciences 61:36-41.

U.S. Army Corps of Engineers (Corps). 2009. *Draft* Bonnet Carré Spillway Master Plan. Prepared by USACE New Orleans District, New Orleans, Louisiana. Updated May 2009. 212 pp.

U.S. Army Corps of Engineers (Corps). 2011. Mississippi River Flood Control: Spillway Operation effects. Website URL address: <http://www.mvn.usace.army.mil/bCarré/oppeffects.asp>. Last accessed February 15, 2011.

Appendix

Intermediate RSLR for Lake Pontchartrain at Frenier Gage

Wetland Value Assessment Project Information Sheet

October 2012

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

Project Name: LPV HSDRRS Mitigation- Bonnet Carré Site

***Mitigation Potential:** (~~0.63~~ old) **0.62 AAHUs/acre**

Project Type(s): Bottomland hardwood habitat (BLH-wet) habitat reforestation and restoration

Project Area: The Bonnet Carré (BC) Spillway is located 20 river miles upstream from New Orleans near the town of Norco in St. Charles Parish, Louisiana. The BC Spillway is a feature of the Mississippi River flood control project and when in operation directs flood waters into Lake Pontchartrain.

Figure 1. Project Area

Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932 marsh was lost. However, there have been no significant habitat shifts in the Bonnet Carré

Mapping Unit in the last 50 years proving it to be an area of sustainable habitat within an area of need. Since 1956, pockets of fresh marsh have developed in the unit and shoreline erosion is a detriment along the lake rim. While subsidence in the area is estimated at 1.1-2.0 ft/century, future land loss projections show no significant wetland loss in this unit over the next 50 years. Shoreline erosion is expected to continue along the lake (Coast 2050 Report- Appendix C 1999).

According to the Bonnet Carré Spillway Master Plan the estimated frequency of spillway operation is once every 10 years. In the 76 years the spillway has been available for use it has been opened nine times (during the floods of 1937, 1945, 1950, 1973, 1975, 1979, 1983, 1997, and 2008). All 350 bays were opened except in 1937, 1975, 1997, and 2008 when 285, 225, 298, and 160 bays were used, respectively. During the 1937 flood, the spillway was open for two months and lowered river stages at New Orleans by 3.5 feet. Dates and maximum flows for each opening are provided in the table below.

Table 1: Bonnet Carré Spillway Openings

Year	Dates of operation	Bays Open	Maximum Flow (cfs)
1937	28 Jan to 16 Mar	285	211,000
1945	23 Mar to 18 May	350	318,000
1950	10 Feb to 19 Mar	350	228,000
1973	8 Apr to 21 Jun	350	207,000
1975	14 Apr to 26 Apr	225	110,000
1979	17 Apr to 31 May	350	228,000
1983	20 May to 23 Jun	350	268,000
1997	17 Mar to 18 Apr	298	243,000
2008	11 April to 8 May	160	160,000
2011*	BC opened since 2008		

The St. Charles Parish Soil Survey classifies soils in the Bonnet Carré Spillway as Convent-Commerce soils which are level to gently undulating, somewhat poorly drained and are loamy throughout. Elevation ranges from 0 -15 feet above sea level. The soils are subject to scouring and deposition by fast flowing diversion waters. The convent and commerce soils correlate with the ridge and swale topography also described by Howard and Penfound (1942) as "Crevasse Topography" which is the deposit of sediments through a crevasse forming an extensive area of alternating ridges and swales. Convent soils are on the low ridges and are characterized as having a brown silt loam, fine sandy loam, and very fine sandy loam surface layer. The Commerce soils are in the swales between the ridges and are characterized as having dark brown silt loam or very fine sandy loam surface layer. The soils, if left undisturbed, are moderately well suited to the production of hardwood trees. Seeding mortality due to frequent flooding are noted in the soil survey as a concern in management (McDaniel 1987).

The amount of sediment deposited in the spillway varies with each opening and is estimated by using cross-sectional surveys. The 1973 flood deposited an estimated total of 12 million cubic yards (USACE 2009). It is estimated that with each opening, the river deposits an average of 9 million cubic yards of sediment, mostly silts and sand, within the floodway (Corps 2011).

Project Goal: Mitigate approximately 52.09 aahus of BLH-Dry habitat (can be mitigated with BLH-wet), and 41.46 aahus of BLH-wet.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for bottomland hardwoods attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V_1 - Stand Structure

Existing –

Bonnet Carré Spillway Master Plan 3-4:

> Approximately 40 percent of the spillway is forested. Two major forested types and two non-forested vegetation types are recognized in the spillway. The total forested area in the Bonnet Carré Spillway is approximately 3,020 acres, or 40 percent of the total spillway acreage. The vast majority of these forested areas (approximately 2,780 acres, or 92 percent of the total) are located between U.S. 61 and Lake Pontchartrain.

The project area is located within the non-forested area of the Bonnet Carré known as the French Cut. This area has been degraded by past clay excavation activities. All of the historic bald cypress in this northern portion close to the lake has been killed, likely as a result of increased salinities.

Aquatic Vegetation in Canals and Ponds. Many various size canals and ponds are located within the spillway. Most of these are shallow and are filled with aquatic vegetation, while others are deeper and exhibit open water. Emersed, floating and submersed plants in these waterbodies include water hyacinth (*Eichhornia* spp.), delta duckpotato (*Sagittaria platyphylla*), duckweeds (*Lemna* spp.), alligatorweed, water pennywort (*Hydrocotyle bonariensis*), mosquito fern (*Azolla* spp.), sedges and rushes (*Carex* spp.), *Cyperus* spp., *Juncus* spp., floating waterprimrose (*Ludwigia peploides*), and pickerelweed (*Pontederia rotundifolia*).

Disturbed Areas. These areas have been modified to a great extent by man. Land clearing for the spillway eliminated bottomland hardwood and baldcypress-tupleo gum swamp forests. Different plant communities may be found in these disturbed areas following each operation of the spillway. Sand-loving colonizers become established on dunes formed from deposition of river alluvium. Perennial herbs are more common in the disturbed areas following successional trends after several years without a spillway operation. A variety of plants may be found in these disturbed areas. Common species are carpetweed (*Mollugo*spp.), southern waterhemp (*Amaranthus* sp.), pigweed (*Amaranthus* spp.), mock bishopweed (*Ptilimnium macrospermum*), ragweed (*Ambrosia* spp.), asters, spiny thistle (*Cirsium horridulum*), yankeeweed (*Eupatorium compositifolium*), goldenrod (*Solidago* spp.), cocklebur (*Xanthium* spp.), peppergrass (*Lepidium* spp.), morning glories (*Ipomra* spp), wolly croton (*Croton capitatus*), coffeeweed (*Sesbania* spp.), clovers (unknown), polly-prin (*Polypremum procumbens*), ironweed (*Vernonia* spp.), evening primroses (*Oenothera biennis*), wood sorrel (Oxalis spp.), bushy beardgrass (*Andropogon glomeratus*), Bermuda grass (*Cynodon dactylon*), Dallis grass (*Paspalum dilatatum*), smartweeds, buttercups (*Ranunculus* spp.), bedstraw (*Galium* spp.), vervain (*Verbena* spp.), peppervine, and numerous grasses, rushes and sedges. These disturbed areas have a rich and diversified flora.

FWOP – Currently, the forested areas on spillway lands lack a hard mast component, therefore, natural recruitment is unlikely in the short term. The BC Master Plan indicates that areas that are not mowed will be cleared of willows, but vegetation through natural colonization of volunteers will be allowed unless otherwise managed for recreation or wildlife. Because of the disturbed topography (primarily described as ponds and sand ridges) early successional species, e.g. perennial herbs and occasionally willow, will continue to proliferate in the project area.

- TY 0 – 50: Class 1

FWP –
Land shaping/grading would be required to restore surface grades to elevations that would

support forested habitat (e.g., 3+ feet elevation for BLH-dry, 2-3 feet elevation for BLH-wet, 1.5-2 feet elevation for swamp) and to allow for natural hydrologic patterns to occur. Tidal signatures are observed inland to Airline Highway. Also, during easterly driven high tides and storm tides the project area is inundated with several feet of water (Brantley 2011). Although projected Relative Sea Level Rise (RSLR) estimates (Appendix) predict that a sea-level rise of 2.0 feet is projected for the year 2063 under the Intermediate RSLR scenario, sediment input from spillway openings should keep up with those estimates. An average of 9 million cubic yards of sediment, mostly silts and sand, is deposited within the floodway with each opening, and openings occur on average every 10 years.

Service BLH mitigation guidelines suggest that the entire acreage be planted with mast-producing species suited to the soil(s) and site conditions. Mid-story species (i.e., shrub species) could include mayhaw, hawthorn, and persimmon. Planting of mast-producing species would be on by 9-foot x 9-foot centers (538/acre) and mid-story species on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees. Hard to soft mast tree species ratio should range between 60 and 70 hardmast species to 30-40 softmast species.

The Bonnet Carre Master Plan indicates that desirable species such as nuttall oak, overcup oak, water oak, cow oak (*Quercus michauxii*), American beech (*Fagus grandifolia*), green ash, pignut hickory (*Carya glabra*), water hickory (*Carya aquatica*), sweet pecan and persimmon should be planted to restore forested areas. The establishment of these species would increase hard mast production in forested areas as well as adding some additional soft mast. Manipulation of the species composition would improve the quality of spillway forested areas for wildlife (Corps 2009).

The St. Charles Soil Survey indicates that the mapping unit is well suited for water/flood tolerant tree species such as American sycamore, eastern cottonwood, nuttall oak, overcup oak, sugarberry, water hickory, and green ash.

Trees are 1 yr. saplings at time of planting (TY2). Class 5 is assumed when trees are 10 years old (producing acorns, TY11). Typically Target year 1 is the first year of achieving benefits in a WVA model. For this project the construction schedule has been incorporated into the benefit period (TY 1 +).

- TY-0-1: Class 1
- TY 2: Class 3
- TY 11: Class 5
- TY 20: Class 5
- TY 50: Class 5

Variable V_2 - Stand Maturity

Existing Conditions – Because of the disturbed nature of the area, there is little to no potential for the area to mature into a bottomland hardwood stand within the project life.

FWOP –
TY 0 – 50 – DBH < 0.01

FWP –
TY 1: age = 0
TY 2: age = 1
TY 11: age = 10
TY 20: age = 19
TY 50: age = 49

Variable V_3 – Understory/ Midstory

Montz' (1978) evaluation of the 1973 flood effects on vegetation confirmed that, while extended periods of inundation kills most annual vegetation, re-colonization is immediate occurring within weeks after floodwaters subsided. He also observed that perennials were not apparently adversely affected by floodwaters of the 1973 spillway operation which apparently deposited a considerable amount of alluvium. Of importance is to note that *Baccharis spp.* and *Iva frutescens* was adversely affected by the floodwaters as was seedlings and small saplings of many hardwood species.

Existing -
With the lack of canopy cover the project area is dominated by herbaceous vegetation as previously noted. The French Cut area is dominated by scrub shrub species such as eastern baccharis and species of willow.

FWOP - Existing conditions will continue to proliferate.
TY 0- 60/40 (Understory/Midstory)
TY 50 – 60/40 (U/M)

FWP – It is suggested that some shrub/scrub species (e.g., mayhaw, hawthorn, and persimmon) be planted to ensure diversity within the forest.
TY 1 – 0/0 (U/M)
TY 2– 100/0 (U/M)
TY 11 – 25/60
TY 20 – 25/60
TY 50 – 35/30

Variable V_4 – Hydrology

Existing
The French Cut area has been degraded by past clay excavation activities and many various size canals and ponds are located within the spillway. During excavation activities sands were side cast creating sand ridges around excavated ponds. Ponds are connected and gaps and culverts allow some limited exchange with canals. Tidal signatures are observed inland to Airline Highway. Also, during easterly driven high tides and storm tides the project area is inundated with several feet of water providing input of nutrients and dissolved oxygen. Although projected

RSLR estimates (Appendix) predict that a sea-level rise of 2.0 feet is projected for the year 2063 under the Intermediate RSLR scenario, sediment input from spillway openings should keep up with those estimates. Therefore, spillway lands should not experience increased hydrologic conditions.

The Bonnet Carré Spillway Structure has been opened 9 times* in its 80 years of existence (construction was complete in 1931). During the high water season on the Mississippi River (*e.g.,* late winter through spring), floodwaters leak between the timber needles and enter the floodway. The volume of this leakage can range from 100 cubic feet per second (cfs) to as much as 9,000 cfs, and the flow can last for several weeks to several months. Some years there is very little or no leakage through the structure and the effects are negligible in the floodway. This introduction of fresh water simulates the natural cycle of overbank flooding and provides numerous benefits to the aquatic and terrestrial resources in the spillway. These benefits include improved water circulation in the spillway's water bodies, nutrient introduction which provides short- and long-term benefits to the ecosystem, and restocking of fishery resources. Leakage events probably serve to scour entry channels from the lake enabling estuarine species to enter and complete life cycles in this vital nursery area. The flooding which results from these leakage events, although not as significant as spillway openings, occurs approximately every other year (Corps 2009).

FWOP- Existing conditions will persist. On average, approximately every other year during high water events (late winter –spring) the floodway will experience overbank flooding ranging in volume between 100 - 9,000 cfs. The project area will continue to experience seasonal and storm driven tidal exchange that will inundate the area.

FWP- Project area elevations will be restored to a more natural topography improving surface hydrologic conditions through rain rainfall and tidal input. The project area will continue to experience overbank flooding approximately every other year during high water events (late winter –spring).

3 March 2012 guidance document: TY2 containment dikes degraded or gapped.

Table 2: Projected FWP and FWOP Hydrologic Conditions

		Flooding Duration	**Flow/Exchange**	**SI**
FWOP		Permanent	Moderate	0.45
FWP	**TY 1**	Dewatered	None	0.0
	TY 2-50	Seasonal	Moderate	0.75

<u>Variable V_5 - Size of Contiguous Forested Area</u>

The project area is located within the Bonnet Carré Spillway which encompasses over 7,000 acres of contiguous forested and marsh habitats.

FWOP: TY 0-50 - Class 1

FWP:

TY2 – 1 yr old saplings planted. = Class 1
TY 11 (10 years old - considered forested) = Class 5
TY 20 = Class 5
TY 50 = Class 5

Variable V_6 – Suitability and Traversability of Surrounding Land Uses

FWOP

Land Use:

BLH/Marsh = 94%
Overgrown habitat/Pasture/ROW = 4%
Open Water = 2%

FWP

Because flooding of spillway lands essentially halts most development, land use is not expected to change within the spillway for FWP. FWP conditions same as above.

Variable V_7 – Disturbance

The project area is located within the Bonnet Carré Spillway which encompasses over 7,000 acres of forested habitat and mixed recreational and clay borrow areas.

Forested ATV use within 200 feet: D Class 2/ T Class 2 = 0.50

FWOP & FWP SI = 0.5

Literature Cited

Brantley, 2011. Personal communication with Mr. Chris Brantley, Bonnet Carré Spillway manager. February 8, 2011.

Howard, J.A. and W.T. Penfound. 1942. Vegetational Studies in Areas of sedimentation in the Bonnet Carré Floodway. Bulletin Torrey Botanical Club 69:281-289.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

McDaniel, Donald. 1987. Soil Conservation Service Soil Survey of St. Charles Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

Montz, G.N. 1978. Vegetational Studies on the Effects of the 1973 Operation of the Bonnet Carré Spillway in Louisiana. Proceedings of the Louisiana Academy of Sciences 61:36-41.

U.S. Army Corps of Engineers (Corps). 2009. *Draft* Bonnet Carré Spillway Master Plan. Prepared by USACE New Orleans District, New Orleans, Louisiana. Updated May 2009. 212 pp.

U.S. Army Corps of Engineers (Corps). 2011. Mississippi River Flood Control: Spillway Operation effects. Website URL address: <http://www.mvn.usace.army.mil/bCarré/oppeffects.asp>. Last accessed February 15, 2011.

Appendix

Intermediate RSLR for Lake Pontchartrain at Frenier Gage

Wetland Value Assessment Project Information Sheet

October 17, 2012

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service
David Castellanos
David_Castellanos@fws.gov

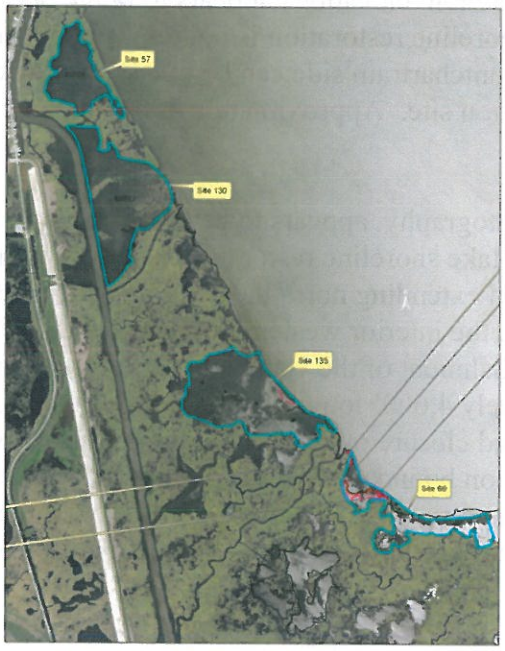
Project Name: LPV HSDRRS Mitigation- Bayou Sauvage Flood Side Marsh Creation Site

***Mitigation Potential:** 0.42 (AAHUs/acre)

Project Type(s): Marsh Creation

Project Area: The Bayou Sauvage Marsh Creation site is located within the the Bayou Sauvage National Wildlife Refuge (BSNWR) at the extreme east but within the city limits of New Orleans, in Orleans Parish, Louisiana (Figure 1). The site is south of I-10 along the shoreline of Lake Pontchartrain

Figure 1. Project Area



Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932

marsh was lost (Coast 2050 Report- Appendix C 1999). The project area is impacted by natural subsidence and wave erosion of the shoreline marshes.

Project Goal:

This project feature requires the creation of 386.6 acres of brackish tidal marsh. Based on limited existing survey data, it is apparent that proposed marsh creation sites have existing bottom elevations generally between -2.0 and -4.0 NAVD88; significantly deeper than originally anticipated. The anticipated borrow requirements will be adjusted higher to accommodate these water depths. A 6 April 2011 site visit further confirmed water depths at specific sites, and this data will be compiled and used to better define required fill quantities. As shown on the attached plan view, seven (7) proposed marsh creation sites are still under consideration, and add up to a total acreage of 598 acres. The sites will be defined herein by acreage numbers, generally from north to south. To create a proposed plan to accommodate the proposed 386.6 acres sites (57, 130, 135, and 69) were selected yielding a total of approximately 391 acres. These sites, all along the Lake Pontchartrain shoreline were selected to assure longevity of the existing land bridge. This was partially accomplished with proposed stone foreshore construction and rehabilitation. Continued breaching and erosion of the shoreline would ultimately be detrimental to all proposed sites. Aquatic vegetation exists in the protected waters of these proposed footprints. Where the footprints open up to the lake and/or backside navigation canal, the vegetation is not nearly as prevalent.

Site 57 appears totally enclosed by adjacent wetlands. Retention dikes, providing 2 feet of freeboard during dredging operations would be constructed around the perimeter to assure vertical accretion of dredged materials. Based on the site visit data and a few additional available survey points, the bottom elevations appears to range between -2.0 and -3.0 feet NAVD88. Although lake shoreline restoration is not totally proposed for this fill site, the retention dike on the Lake Pontchartrain side can be overbuilt in width as required to assure longevity of this marsh creation site. Approximately 450,000 cubic yards of fill will be required to achieve target elevation.

Site 130, based on aerial photography, appears to be breaching into the lake. To preserve the integrity of this land bridge, lake shoreline restoration is proposed in the form of a stone foreshore dike, tying into and extending north the existing rock foreshore protection that currently exists. In addition, the interior western boundary abuts and is open to an existing waterway, requiring reestablishment of the waterway shoreline prior to pumping dredge material. An earthen dike, approximately 4,600' long is proposed for this effort. Existing water bottom elevations along this proposed closure range from -2.0 to -2.5 feet NAVD88. The remaining perimeter of the marsh creation boundary will require a standard retention dike, providing 2' of freeboard during pumping operations. The water bottom elevation with this cell appears to be -2.0 feet NAVD88. Approximately 900,000 yards will be required to fill this site.

Site 135 is bounded totally on the Lake Pontchartrain side by an existing rock dike. The rock dike will require a construction lift to assure retention of dredged material. The remainder of the cell perimeter will require a retention dike. It was anticipated that bottom elevations within the cell range from -2.0 to -4.0 feet NAVD88. Initial analysis of the site visit data reveals that bottom elevations along the inside of the rock dike range from -4.0 feet to approximately -6.0 at the existing access gaps. Depths along the interior shoreline range from 2.0 feet to 4.0 feet. Estimated fill quantities for this element are approximately 1.4 million cubic yards of fill material.

Site 69 is also bounded totally on the Lake Pontchartrain side by an existing rock dike. The rock dike will require a construction lift to assure retention of dredged material. The existing rock dike ends in open water at its eastern limit, requiring a closure dike (rock or earthen) along the eastern side of the marsh creation site to retain material. The bottom elevations along this required closure alignment are estimated at approximately -3.0 to -3.5 feet. The closure alignment would be tucked inside the rock dike to afford protection from wave action during and post construction. Site visit results estimate average water depths in this cell at approximately -3.0 feet, which is consistent with the other proposed sites. Approximately 600,000 yards of fill material is anticipated.

Two borrow sites with Lake Pontchartrain are proposed for this effort. Borrow will be limited to 10feet below the existing water bottom. Each primary site is sized at 75 acres (north) and 100 acres (south), but will be doubled for this 35% design to accommodate unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds (see drawing). Currently, no pipelines are known to obstruct the borrow sites or fill sites. The borrow plan is to obtain material from Lake Pontchartrain, requiring a buffer of 2000 feet between the existing shoreline and the borrow area limit. Marsh creation would require borrow of approximately 3.4 million cubic yards of material.

Initial target elevation for dredge fill would be to elevation +2.5 feet NAVD88 to ultimately hit a target marsh elevation ranging from +1.5 to +1.0 feet. Existing marsh elevations, based on existing survey data appear to be approximately 1.0 feet NAVD88.

Based on review of aerial photography, it is recommended to include rock shoreline restoration of approximately 3100 feet and 4900 feet in length respectively for sites 135 and 69, and rock foreshore construction of approximately 3100 feet for sites 57 and 130. While the existing rock structures appear to be in fairly good condition, additional height of 1 to 2 feet would assist in retaining dredged material. The dikes can be lined with geotextile fabric to assure minimum turbidity into the lake during construction efforts. Minimal flotation dredging along the lake shoreline may be required to construct this shoreline feature. Earthen bankline restoration of 4600 feet landside will be required for element 130. This earthen restoration feature would also be a part of the required dredge retention feature, but would be constructed with a wider crown to withstand waves.

Maximum allowable flotation access excavation quantities will be used for construction of this foreshore features. While this linear shoreline restoration feature would remain intact post construction, all other perimeter retention dikes will be gapped at existing waterways to assure water interchange with the existing marsh.

Two access corridors will be allowed from the lake to the proposed marsh creation site for each borrow site. These corridors will be restricted to 200 feet in width and can be used to establish a pipeline corridor, offload equipment as necessary, and transport personnel to and from the worksite.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for marsh habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V_1 - Percent of wetland area covered by emergent vegetation

Existing – The project area is mostly open water with a few areas (16 acres) of marsh totaling 4 % of the entire project area. The project area and surrounding marsh has been classified as

brackish marsh consistently from 1949 to 2007 (O'Neil 1949, Chabreck and Linscombe 1997, Sasser et al. 2007).

The two major soil types in the project area are classified by Trahan (1987) as Lafitte muck and Clovelly muck. Both soil types are very poorly drained, very fluid organic soils typical of brackish marsh. They are generally flooded and ponded most of the time and have a high subsidence potential.

Land Loss Data

Figure: 2. USGS Extended Boundary for Bayou Sauvage (09)

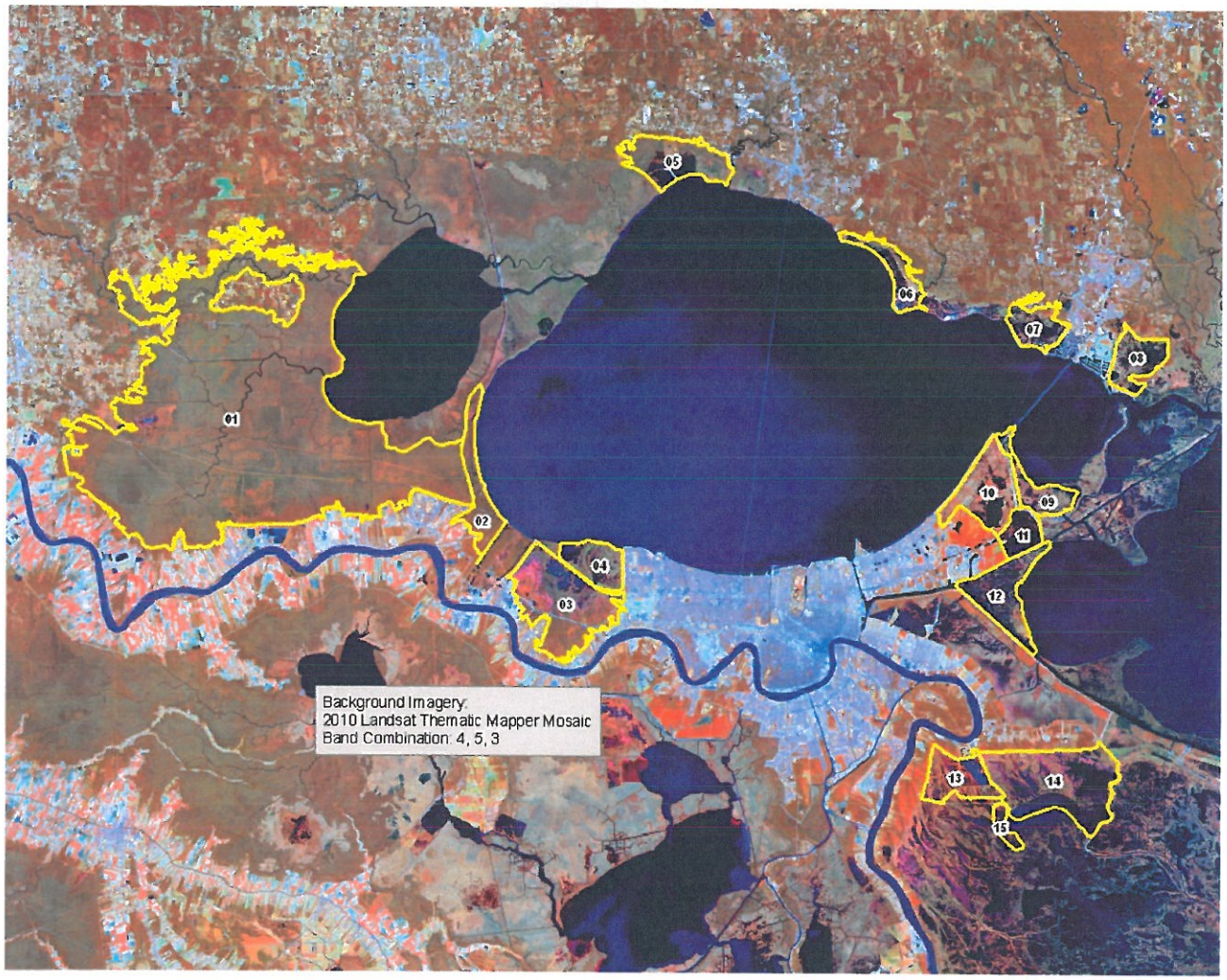
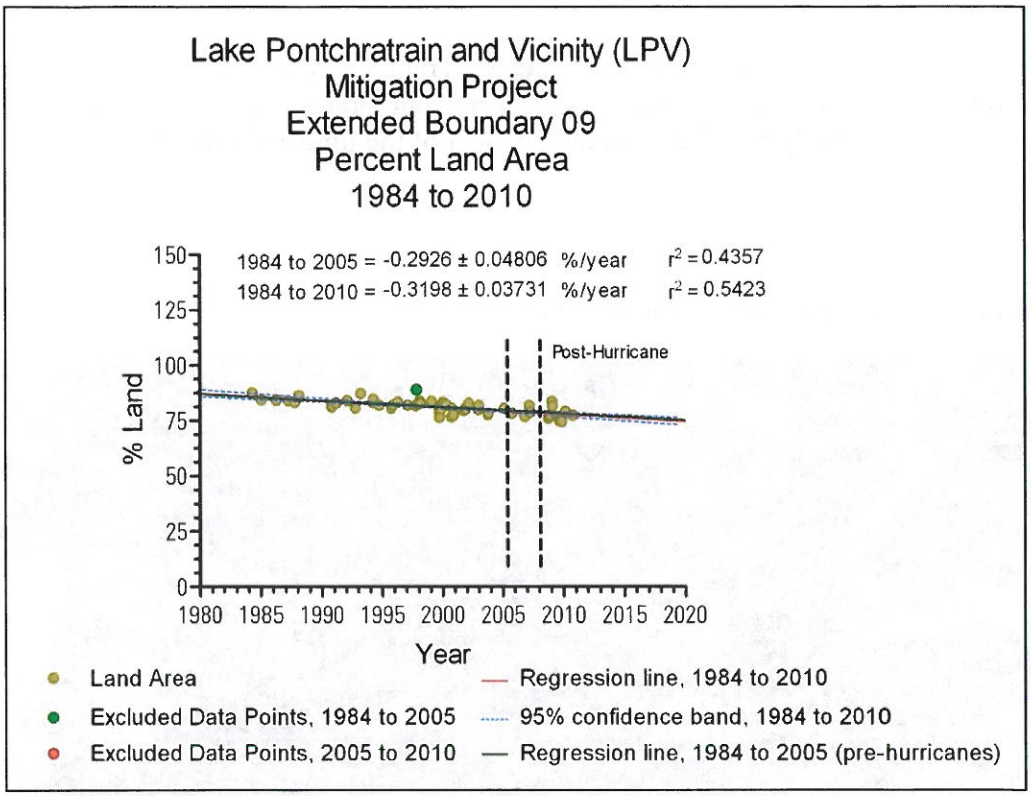


Figure 3. Land loss rate determined by USGS



The Fish and Wildlife Service calculated land loss rate using the same USGS Land/Water data, but with a different regression (Land Acres : Time). That rate was used to calculate land/water values over the life of the project.

Extended Boundary Percent Loss Rate = -0.0037

Project Area Acre per year lost rate

FWOP
BSFS1 = -0.25
BSFS2 = -0.51
BSFS3 = -0.48
BSFS4 = -0.21

FWP (but rate reverts back to FWOP rate when water level rise equals 10 inches)
BSFS1 = -0.123
BSFS2 = -0.254
BSFS3 = -0.239
BSFS4 = -0.107

Land loss rates were adjusted by the projected effects of three Relative Sea Level Rise (RSLR) scenarios. The medium RSLR scenario was chosen for these analyses.

FWOP – Under the medium RSLR scenario, the adjusted marsh loss rate would result in the losses as below. Percent is of the entire project area acreage and are rounded to be accepted into excel model.

TY0
Marsh: 15.96 acres (4.13%)
Water: 370.64 acres (95.87%)

TY1
Marsh: 14.52 acres (3.76%)
Water: 372.08 acres (96.24%)

TY3
Marsh: 11.58 acres (3.00%)
Water: 375.02 acres (97.00%)

TY5
Marsh: 8.59 acres (2.22%)
Water: 378.01 acres (97.78%)

TY6
Marsh: 7.07 acres (1.83%)
Water: 379.53 acres (98.17%)

TY25 – TY50
Marsh: 0 acres (0%)
Water: 386.6 acres (100%)

FWP – It is assumed that all acres within the project area would be marsh creation (i.e., no marsh nourishment assumed); this was to simplify for the AEP alternatives analysis. Created marsh platform has limited marsh function until settlement and breaching of retention dikes. Landloss is applied at the time of marsh creation. The rate is 50% of the background loss rate until TY24 when at least10 inches of water is assumed to cover the marsh and background loss rate is resumed. Percent is of the entire project area acreage and are rounded to be accepted into excel model.

TY0
Marsh: 15.96 acres (4.13%)
Water: 370.64 acres (95.87%)

TY1
Non-functional
marsh platform: 347.94 acres (90.00%)

Marsh:	38.66 acres (10.00% [0.1 credit factor applied])
Water:	0 acres (0%)

TY3

Non-functional marsh platform:	288.84 acres (74.71%)
Marsh:	96.28 acres (24.9% {0.25 credit factor applied})
Water:	1.48 acres (0.38%)

TY5:

Non-functional marsh platform:	0 acres (0%);
Marsh:	383.59acres (99.22% - assume all existing created marsh platform converted to marsh [full credit; 1.0 credit factor])
Water:	3.01 acres (0.78%)

TY6:

Marsh:	382.80acres (99.01%)
Water:	3.80 acres (0.98%)

TY24

Marsh:	365.28 acres (94.48%)
Water:	21.32 acres (5.52%)

TY50:

Marsh:	313.45 acres (81.08%)
Water	73.15 acres (18.92%)

Variable V_2 - Percent of open water covered by aquatic vegetation

Existing Conditions –The project area is primarily shallow open water with SAV abundant in all sites. Optical area estimation and transect visual sampling for presence or absence was conducted on April 6, 2011 by USFWS, NOAA, and Corps personnel. It was estimated that 83% of the open water area had SAV cover dominated by *Myriophyllum spicatum* (Eurasian watermilfoil).

FWOP – Existing conditions are expected to continue, with a decline in abundance as RSLR causes water depths to increase thus attenuating light penetration through the water column and reducing growth. Also, as the surrounding marsh decreases, 2 sites will eventually open to Lake Pontchartrain. Even without those breaches, the size of the open water area will increase, which will increase the fetch and wave energy. Increased wave energy may lead to increased turbidity and will also affect the amount of light available for optimal SAV growth. The existing foreshore rock dikes will provide diminishing wave energy protection for SAV at 2 sites as they subside below the water level.

TY 0 83%
TY 25 62% (75% of baseline; losses due to factors described above)
TY 50 12% (15% of baseline; assume 85% loss from baseline – standard assumptions)

FWP – When the marsh land platform is constructed, all existing SAV will be buried. Until the created marsh platform settles to marsh elevation and the retention dikes are breached, it is assumed that very little open water, or SAV volunteers exists to support SAV growth.

TY 0	83%
TY 1	0%
TY 3	0%
TY 5	83% (100% of baseline)
TY 6	91% (increase baseline by 10%)
TY 25	91% (increase baseline by 10%)
TY 50	21% (25% of baseline; 75% loss from baseline – standard assumptions)

Variable V_3 - Marsh edge and interspersion

Existing Conditions – The project area contains only small marsh fragments in three of the four sites that make up the project area. The marsh area is 5% of the total project area; therefore the project area is assigned a Class 5 value for TY 50.

FWOP –.
TY 0 – 50: 100% Class 5 (no new marsh is gained; existing marsh converts to open water)

FWP –

TY 0:	100 % Class 5
TY 1	100% Class 5
TY 3	100% Class 3 ("carpet marsh")
TY 5	50% Class 3, 50% Class 1
TY 6	100% Class 1
TY 24	95% Class 1; 5% Class 2 (marsh is ~95%)
TY 50	50% Class 2; 50% Class 3 (marsh is ~81%)

Variable V_4 - Percent of open water area <=1.5 feet deep in relation to marsh surface

Existing
Water depths were measured with a survey rod in the project area on 6 April 2011. The average water depth for the area was calculated using the nearby CRMS3626 gage data and data from the Rigolets at Lake Pontchartrain gage. Using the gage data, the collected data was corrected for the effect of the tides and wind on the day the measurements were recorded. The Corps' RSLR estimates predict a sea-level rise of approximately 2.0 feet for the year 2063 under the Intermediate RSLR scenario (Appendix). It was assumed that RSLR will reduce the existing shallow open water for FWOP and FWP at TY50 by 1/3 and 1/6 respectively.

FWOP

TY0	15%
TY1	15%
TY3	15%
TY5	15%
TY6	15%
TY25	15%
TY50	10%

FWP- the mitigation project land platform would be built to a subaerial elevation with dredged material. Marsh that is lost is assumed to become open water <= 1.5 feet deep until TY50. At that point, it is assumed that 1/6 of the shallow open water would become deeper than 1.5 feet.

TY0	15%
TY1	100%
TY3	100%
TY5	100%
TY6	100%
TY24	100%
TY50	83% (24.3 of 146.3 acres of shallow water becomes deep)

Variable V_5 - Salinity

Existing conditions - Currently estimates for salinity in the area are available from the CRMS3626 station which is very near vicinity of the project area (almost in site 135). The mean salinity recorded by that station for the 2010 growing season was 3.65 ppt.

FWOP & FWP
TY0 – TY50 3.65 ppt

Variable V_6 – Aquatic organism access

Existing conditions – The four sites that make up the project area are not impounded or hydrologically controlled by any structures. There is a foreshore rock dike between the project area and Lake Pontchartrain, but there is a hydrologic connection of the project area marsh through bayous and a canal to the open waters of the lake and the surrounding marsh. Access to all parts of project area is assumed to be equal.

FWOP Existing conditions are expected to perist.
TY0 – TY50 = 1.0

FWP After construction, retention dikes will block all aquatic organism access. After the dikes

are breached in TY3, it is assumed that aquatic organisms will have total and equal access to sites that make up the project area.

TY0	1.0
TY1	0.0001
TY3	0.0001
TY5 – TY50	1.0

Literature Cited

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

Trahan, Larry. 1987. Soil Conservation Service Soil Survey of Orleans Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

Wetland Value Assessment Project Information Sheet

April 2011

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

Project Name: LPV HSDRRS Mitigation- Bayou Sauvage Protected Side BLH Restore Site

***Mitigation Potential:** 0.56 AAHUs/acre

Project Type(s): BLH Restoration

Project Area: The Bayou Sauvage BLH restoration site is located within the south impoundment unit of the Bayou Sauvage National Wildlife Refuge (BSNWR) at the extreme east but within the city limits of New Orleans, in Orleans Parish, Louisiana (Figure 1). The site is north of the north bank of the GIWW, approximately 2.75 miles east of Michoud Slip, and adjacent to the Maxent outfall canal along Recovery Drive.

Figure 1. Project Area

The mitigation project site is also located within the The Bayou Sauvage Hydrologic Restoration (BSHR) Coastal Planning Protection and Restoration Act (CWPRRA) project. The Lake Pontchartrain Hurricane Protection Levee, built in 1956, hydrologically isolates the project area from the surrounding estuary. Along with Maxent Canal levee and the railroad embankment the area is completely impounded with water depths ranging from approximately 2 to 3 feet (U.S.

Fish and Wildlife Service [USFWS] field trip data 06 April 2011). The construction of these levees eliminated natural tidal flow, leaving precipitation as the only source of water input for the area. The BSHR CWPPRA project area is divided into two units (North Unit and South Unit) that are separated hydrologically by a railroad embankment. Following the construction of the Hurricane Protection Levee, the Maxent Canal levee was breached, and the South Unit was drained for an extensive time period, causing oxidation and compaction that lead to accelerated marsh loss. The Orleans Parish Soil Survey classifies the soils in the project area as Lafitte much which are very poorly drained, very fluid, organic soil usually found in brackish marshes that are subject to extreme shrinkage when dewatered (Trahan 1987). The North Unit was not exposed to this drainage, and therefore experienced more gradual marsh loss (USFWS 1991).

Approximately 117 ac/yr (47 ha/yr) of marsh habitat were lost from 1956 to 1978 throughout the entire refuge (USFWS 1994). Within the project area units, land loss was 81 ac/yr (32 ha/yr) (69% of the total land loss), resulting primarily from the processes described above (USFWS 1994). The Bayou Sauvage BLH PS mitigation project area has been classified as intermediate marsh since 1997. From June 1997 to January 1998, the water salinity in the South Unit ranged from 0 ppt to almost 8 ppt.

The objective of the BSHR CWPPRA project is to enhance emergent marsh and BLH habitats (mostly black willow) for wading bird rookeries). The specific hydrologic goal is to lower water levels to within the range of 0 - -0.5 ft below marsh elevation during the spring and summer (growing season), and to within 0 -+0.5 ft above ME during the fall and winter.

To reach achieve the hydrologic goal of the BSHR CWPPRA project, a 48-in (1.2-m) pump was installed in each unit to lower water levels. A weir was installed across a small trenasse on the south bank of Bayou Thomas to ensure that the units are hydrologically isolated when water levels in the north unit fall to the level of the weir. An example of pump operation between 1996 and 1998 by USFWS personnel is shown in the following table.

	USFWS operations of the Bayou Sauvage Hydrologic Restoration (PO-16) pumps in the North and South Units.		
		Operation	
Date	Pump 5 (North)		Pump 6 (South)
Spring/Summer 1996	25 days of operation	14 days of operation	
Fall/Winter 1996-97	10 days of operation	5 days of operation	
Spring/Summer 1997	19 days of operation	33 days of operation	
Fall/Winter 1997-98	26 days of operation	34 days of operation	
Spring/Summer = Mar. 21 - Sept. 23 Fall/Winter = Sept. 24 - Mar. 20			

Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932 marsh was lost (Coast 2050 Report- Appendix C 1999). As stated previously in the project description section, multiple factors contributed to the land loss in the impounded south unit. Apparently, up to this point, BSHR CWPPRA project operations have not been effective in enhancing emergent marsh in the area. The water depths in the impoundment may be too high to control with the structures and pumps currently in operation. The proposed mitigation project would raise the substrate elevation to a level that would allow control of inundation duration.

Project Goal: Create approximately 53 acres of BLH habitat within the BSNWR south impoundment. As currently proposed, the project would be constructed along the western boundary of the project area, immediately south of the Recovery landfill. The project area is identified in solid green on Sheet Identification "BSNWR-PS1".

The project will consist of creating approximately 50 acres suitable for creating BLH-W habitat. At this time, no borrow source/location has yet been specified, but it is noted that borrow could be obtained from the Mississippi River, Lake Borgne, or Lake Ponchartrain. In addition to these potential borrow sources, the Corps' Michoud Canal project, which is in the immediate vicinity of the project area, could be considered as an optional source for borrow. However, it should be noted that the Michoud Canal project would not provide enough material to construct this restoration feature. If borrow were to be obtained from the Mississippi River or Lake Ponchartrain, the material would be placed within barges and then transported to the project site where it would then be pumped to the restoration site via a portable slurry processing unit. If Lake Borgne were to be used as the borrow source, then the material could either be pumped directly from the borrow pit to the restoration site or transported via barge and offloaded as described above for the Mississippi River and Lake Ponchartrain options. If borrowed from either Lake Borgne or Lake Ponchartrain, borrow would be restricted to maximum depths yet to be determined. Approximately 400,000 gross cubic yards required for the BLH-W restoration. Disposal within restoration site P1 will be confined, with dredge effluent waters allowed to either be returned to the adjacent outfall canal via spill box weirs, or if allowed, to be discharged immediately east of the restoration site. Access for the dredge pipeline would be across the hurricane protection levee running along the north bank of the GIWW. Additional pipeline and equipment (i.e. marsh buggies for dike construction) could also be brought in from the north via Chef Menteur Hwy/Hwy 90 and Recovery Drive.

As no geotechnical data or surveys of the site are currently available, it is currently anticipated that all retaining dikes for this feature will be earthen and constructed from adjacent borrow to be obtained from within the marsh or BLH restoration site. Approximately 12,430 feet (approx 5,880 feet of closure dike along the east side and approx 6,550 feet of dikes along existing earthen features) of perimeter earthen retention dikes/closures will be required and a minimum of 1feet of freeboard shall be maintained at all times during pumping operations. In addition, an earthen weir, approximately 1,800 feet in length and separating the north end of the BSmarsh restoration site from the BLH-W site, will also be required. The earthen retention dikes and weir will be constructed to a min 5 feet crown width, slopes no steeper than 1V on 3H, and with a minimum 40 feet interior berm to be maintained between the inside toe of the retention dikes and earthen weirs and the top of cut of the adjacent borrow pits. The perimeter dikes shall be

constructed to an approximate elevation of +5 feet (Datum?) around the adjacent marsh creation site to the south and +6 feet NAVD88 on the east side of the BLH-W site, and the interior earthen weir shall be constructed to an approximate elevation of +3.5 feet NAVD88. Upon completion of the project, the dikes and weir may either be left in place to naturally degrade, or be degraded at a later date after the dredged material has had time to settle out within the restoration site. Some shaping of material may be required in order to get the BLH-W site to the desired grades.

For the approximately 53 acre BLH-W feature, a schedule and plan for tree plantings, including species, quantity and layout, will have to be determined. These plans will be decided by the PDT at the time the final plan is selected.

As stated earlier, surveys of the restoration site are not available. Thus, in order to estimate the amount of borrow material that would be required, it was assumed that the average existing elevation of the restoration site was approximately -1.5 feet NAVD88 Also, all ground line elevations used were based off of available LIDAR data. Detailed surveys of the project area, as well as the borrow site(s) to be used, will be required to verify/ refine the actual quantities and scope of work should this feature proceed to the next phase of design.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for BLH habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat

suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V_1 - Stand Structure

Existing – There is no forest, only open water. The project area contained only small marsh fragments in 1998 and by 2005 there was no vegetation.

FWOP – No habitat change is expected because water levels are not drawn down to a level that would allow natural reforestation.

- TY 0 – 50: No Class value, because there is no forest.

FWP –
Land shaping/grading would be required to restore surface grades to elevations that would support forested habitat and to allow for natural hydrologic patterns to occur.

Service BLH mitigation guidelines suggest that the entire acreage be planted with mast-producing species suited to the soil(s) and site conditions. Mid-story species (i.e., shrub species) could include mayhaw, hawthorn, and persimmon. Planting of mast-producing species would be on by 9-foot x 9-foot centers (538/acre) and mid-story species on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees. Hard to soft mast tree species ratio should range between 60 and 70 hardmast species to 30-40 softmast species.

- TY0: Class 5 as planted but not full function value; not mature canopy
- TY 1: Class 5 as planted but not full function value; not mature canopy
- TY 20 - 50: Class 5 assume full function forest

Potential salinity issues
The water within the impoundment has variable salinities. Also, if the proposed borrow areas in Lake Pontchartrain and Lake Borgne were utilized brackish water and sediment may be introduced into the project area where trees are to be planted. The rate of evaporation and rainfall control the water salinity. Currently estimates for salinity in the area are only available from the north unit (CRMS4107). Salinities in that unit ranged from about 4 ppt to 6 ppt between October 2010 to January 2011. Water from this unit can flow into the south unit over a fixed-crest weir when water levels rise due to rainfall input. Planted vegetation should be chosen that has tolerance for low salinity water or the growth rate in V1 may need to be lowered to account for affects of saline water by inundation or availability in the water

table at the edges of the restoration area that are adjacent to the open water of the impoundment.
FWOP & FWP – 0 – 6 ppt; possibly higher after dredged material added.

Variable V_2 - Stand Maturity

Existing Conditions – There is no forest, only open water. The project area contained only small marsh fragments in 1998 and by 2005 there was no vegetation.

FWOP –
TY 0 – 50 – No habitat change is expected because water levels are not drawn down to a level that would allow natural reforestation

FWP –
TY 1: age = 1
TY 50: age = 50

Variable V_3 - Understory / Midstory

Existing Conditions – There is no forest or subaerial land, only open water. The project area contained only small marsh fragments in 1998 and by 2005 there was no vegetation.

FWOP – Existing conditions will continue indefinitely.
TY 0 – 50: 0/0 (Understory/Midstory)

FWP – It is suggested that some shrub/scrub species (e.g., mayhaw, hawthorn, and persimmon) be planted on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees to ensure diversity within the forest.

TY 0 – 0/0 (U/M)
TY 1– 100/0
TY 20 – 25/60
TY 50 – 30/30

Variable V_4 - Hydrology

Existing
Although projected RSLR estimates predict a sea-level rise of approximately 2.0 feet for the year 2063 under the Intermediate RSLR scenario (Appendix), the water level in the impoundment is a function of three factors: Rainfall, a variable(?) stoplog structure at the west end, and operation of a 48 inch pump on the east boundary of the impoundment, adjacent to the HSDRSS levee. Approximately 10 days are required to remove 1 inch of water (BSNWR management; persn.com). Therefore, the project area should not be affected by sea level rise during the 50 year project life/analysis period.

FWOP- Existing impounded conditions will persist.

FWP- The existing hydrologic control of the impouned south unit would continue according to the BSHR CWPPRA project; however, the mitigation project land platform would be built to a subaerial elevation with dredged material. After the retention dikes are gapped or degraded it is expected that the area could be temporarily inundated because of rainfall raising the water level in the impoundment. The water control structures mentioned previously would drain the water after some time to levels prescribed by the CWPPRA project plan, which presumably would allow complete drainage of the BLH mitigation area.

Table 2: Projected FWP and FWOP Hydrologic Conditions

	Flooding Duration	**Flow/Exchange**	**SI**
FWOP TY0-TY50	Permanent	None	0.10
FWP TY0	Permanent	None	0.10
TY1	Permanent	None	0.10
TY2	Temporary	None	0.50
TY20-TY50	Temporary	None	0.50

Variable V_5 - Size of Contiguous Forested Area

The project area is not forested and therefore only the FWP has a value greater than 0 for this variable.

FWOP: No forest in project area, therefore the contiguous forest variable value is Class 1; 0 to 5 acres.

FWP: Class 3; between 20.1 and 100 acres by TY20. The forest at this point would consist of 53 acres of high value restored BLH, completely functional by TY20, and about 20 acres of other existing contiguous forest.

Variable V_6 – Suitability and Traversability of Surrounding Land Uses

FWOP &FWP

Land Use:

BLH/Marsh = 46%
Overgrown habitat = 8%
Pasture/ROW/Open Water = 45%
Development = 1%

A development rate was not applied to this area. Much of the surrounding land use will be part

of the BSNWR after project construction and new development is not expected because of decreased population and business resulting from Hurricane Katrina. Also, impact assessments were evaluated with the assumption that no development rate increase would be realized through the life of the project.

Variable V_7 – Disturbance

The project area is currently located on City of New Orleans property, but within the acquisition boundary of the BSNWR which encompasses over 7,000 acres of marsh and forests. That property will become part of the BSNWR when the mitigation project is constructed. There is a proposed HSDRSS borrow site within 300 feet of the project, but even if utilized, activity would cease before the mitigation project was constructed. The Recovery landfill is immediately adjacent to the project area, but it is inactive and not expected to be used in the future. The only disturbances within 500 feet are a railroad, and a very lightly used road.

Access road use < 50 feet: D Class 1/ T Class 4 = 1.0

FWOP & FWP SI = 1.0

Literature Cited

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

Trahan, Larry. 1987. Soil Conservation Service Soil Survey of Orleans Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

U.S. Fish and Wildlife Service 1991. Bayou Sauvage National Wildlife Refuge Wetland Restoration: Candidate Project for the Priority Project List of the Coastal Wetlands, Planning, Protection, and Restoration Act. Slidell, La: USFWS. 16 pp.

U.S. Fish and Wildlife Service 1994. Final Environmental Impact Statement: Bayou Sauvage National Wildlife Refuge. Slidell, La.: USFWS. 614 pp.

Wetland Value Assessment Project Information Sheet

April 2011

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

Project Name: LPV HSDRRS Mitigation- Bayou Sauvage Protected Side Marsh Creation Site

***Mitigation Potential:** 0.29 AAHUs/acre

Project Type(s): Intermediate Marsh Creation

Project Area: The Bayou Sauvage Marsh Creation site is located within the south impoundment unit of the Bayou Sauvage National Wildlife Refuge (BSNWR) at the extreme east but within the city limits of New Orleans, in Orleans Parish, Louisiana (Figure 1). The site is north of the north bank of the GIWW, approximately 2.75 miles east of Michoud Slip, and adjacent to the Maxent outfall canal along Recovery Drive.

Figure 1. Project Area

The mitigation project site is also located within the The Bayou Sauvage Hydrologic Restoration (BSHR) Coastal Planning Protection and Restoration Act (CWPRRA) project. The Lake

Pontchartrain Hurricane Protection Levee, built in 1956, hydrologically isolates the project area from the surrounding estuary. Along with Maxent Canal levee and the railroad embankment the area is completely impounded with water depths ranging from approximately 2 to 3 feet (U.S. Fish and Wildlife Service [USFWS] field trip data 06 April 2011). The construction of these levees eliminated natural tidal flow, leaving precipitation as the only source of water input for the area. The BSHR CWPPRA project area is divided into two units (North Unit and South Unit) that are separated hydrologically by a railroad embankment. Following the construction of the Hurricane Protection Levee, the Maxent Canal levee was breached, and the South Unit was drained for an extensive time period, causing oxidation and compaction that lead to accelerated marsh loss. The Orleans Parish Soil Survey classifies the soils in the project area as Lafitte much which are very poorly drained, very fluid, organic soil usually found in brackish marshes that are subject to extreme shrinkage when dewatered (Trahan 1987). The North Unit was not exposed to this drainage, and therefore experienced more gradual marsh loss (USFWS 1991). Approximately 117 ac/yr (47 ha/yr) of marsh habitat were lost from 1956 to 1978 throughout the entire refuge (USFWS 1994). Within the project area units, land loss was 81 ac/yr (32 ha/yr) (69% of the total land loss), resulting primarily from the processes described above (USFWS 1994). The Bayou Sauvage BLH PS mitigation project area has been classified as intermediate marsh since 1997. From June 1997 to January 1998, the water salinity in the South Unit ranged from 0 ppt to almost 8 ppt.

The objective of the BSHR CWPPRA project is to enhance emergent marsh and BLH habitats (mostly black willow) for wading bird rookeries). The specific hydrologic goal is to lower water levels to within the range of 0 - -0.5 ft below marsh elevation during the spring and summer (growing season), and to within 0 -+0.5 ft above ME during the fall and winter.

To reach achieve the hydrologic goal of the BSHR CWPPRA project, a 48-in (1.2-m) pump was installed in each unit to lower water levels. A weir was installed across a small trenasse on the south bank of Bayou Thomas to ensure that the units are hydrologically isolated when water levels in the north unit fall to the level of the weir. An example of pump operation between 1996 and 1998 by USFWS personnel is shown in the following table.

	USFWS operations of the Bayou Sauvage Hydrologic Restoration (PO-16) pumps in the North and South Units.		
		Operation	
Date	Pump 5 (North)		Pump 6 (South)
Spring/Summer 1996	25 days of operation	14 days of operation	
Fall/Winter 1996-97	10 days of operation	5 days of operation	
Spring/Summer 1997	19 days of operation	33 days of operation	
Fall/Winter 1997-98	26 days of operation	34 days of operation	
Spring/Summer = Mar. 21 - Sept. 23 Fall/Winter = Sept. 24 - Mar. 20			

Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932 marsh was lost (Coast 2050 Report- Appendix C 1999). As stated previously in the project description section, multiple factors contributed to the land loss in the impounded south unit. Apparently, up to this point, BSHR CWPPRA project operations have not been effective in enhancing emergent marsh or SAV in the area. The water depths in the impoundment may be too high to control with the structures and pumps currently in operation. The proposed mitigation project would raise the substrate elevation to a level that would allow control of inundation duration.

Project Goal: Create approximately 129.4 acres of intermediate marsh habitat within the BSNWR south impoundment. As currently proposed, the project would be constructed along the western boundary of the project area, immediately south of the Bayou Sauvage mitigation BLH restoration site. The project area is identified in solid green on Sheet Identification "BSNWR-PS1".

The project will consist of creating approximately 129.4 acres of land platform suitable for creating emergent marsh habitat. At this time, no borrow source/location has yet been specified, but it is noted that borrow could be obtained from the Mississippi River, Lake Borgne, or Lake Ponchartrain. In addition to these potential borrow sources, the Corps' Michoud Canal project, which is in the immediate vicinity of the project area, could be considered as an optional source for borrow. However, it should be noted that the Michoud Canal project would not provide enough material to construct this restoration feature. If borrow were to be obtained from the Mississippi River or Lake Ponchartrain, the material would be placed within barges and then transported to the project site where it would then be pumped to the restoration site via a portable slurry processing unit. If Lake Borgne were to be used as the borrow source, then the material could either be pumped directly from the borrow pit to the restoration site or transported via barge and offloaded as described above for the Mississippi River and Lake Ponchartrain options. If borrowed from either Lake Borgne or Lake Ponchartrain, borrow would be restricted to maximum depths yet to be determined. Approximately 400,000 gross cubic yards required for the BLH-W restoration. Disposal within restoration site P1 will be confined, with dredge effluent waters allowed to either be returned to the adjacent outfall canal via spill box weirs, or if allowed, to be discharged immediately east of the restoration site. Access for the dredge pipeline would be across the hurricane protection levee running along the north bank of the GIWW. Additional pipeline and equipment (i.e. marsh buggies for dike construction) could also be brought in from the north via Chef Menteur Hwy/Hwy 90 and Recovery Drive.

As no geotechnical data or surveys of the site are currently available, it is currently anticipated that all retaining dikes for this feature will be earthen and constructed from adjacent borrow to be obtained from within the marsh or BLH restoration site. Approximately 12,430 feet (approx 5,880 feet of closure dike along the east side and approx 6,550 feet of dikes along existing earthen features) of perimeter earthen retention dikes/closures will be required and a minimum of 1feet of freeboard shall be maintained at all times during pumping operations. In addition, an earthen weir, approximately 1,800 feet in length and separating the north end of the BSmarsh restoration site from the BLH-W site, will also be required. The earthen retention dikes and weir will be constructed to a min 5 feet crown width, slopes no steeper than 1V on 3H, and with a

minimum 40 feet interior berm to be maintained between the inside toe of the retention dikes and earthen weirs and the top of cut of the adjacent borrow pits. The perimeter dikes shall be constructed to an approximate elevation of +5 feet NAVD88 around the adjacent marsh creation site to the south and +6 feet NAVD88 on the east side of the BLH-W site, and the interior earthen weir shall be constructed to an approximate elevation of +3.5 feet NAVD88. Upon completion of the project, the dikes and weir may either be left in place to naturally degrade, or be degraded at a later date after the dredged material has had time to settle out within the restoration site.

As stated earlier, surveys of the restoration site are not available. Thus, in order to estimate the amount of borrow material that would be required, it was assumed that the average existing elevation of the restoration site was approximately -1.5 feet NAVD88. Also, all ground line elevations used were based off of available LIDAR data. Detailed surveys of the project area, as well as the borrow site(s) to be used, will be required to verify/ refine the actual quantities and scope of work should this feature proceed to the next phase of design.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for marsh habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to

costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V_1 - Percent of wetland area covered by emergent vegetation

Existing – The project area consists of mostly open water. The project area contained some areas of marsh in 1998. Currently, only the fringe marsh along the southern boundary of the project area remains. We calculated marsh loss using USGS provided loss rates based on regression analysis of land loss between 1985 and 2004. The effect of expected relative sea level rise (RSLR) greater than the current rate was not added to the calculations because the project area water level is artificially controlled by pumps and a stoplog drainage culvert.

Figure: 2. USGS Extended Boundary for Bayou Sauvage (11).

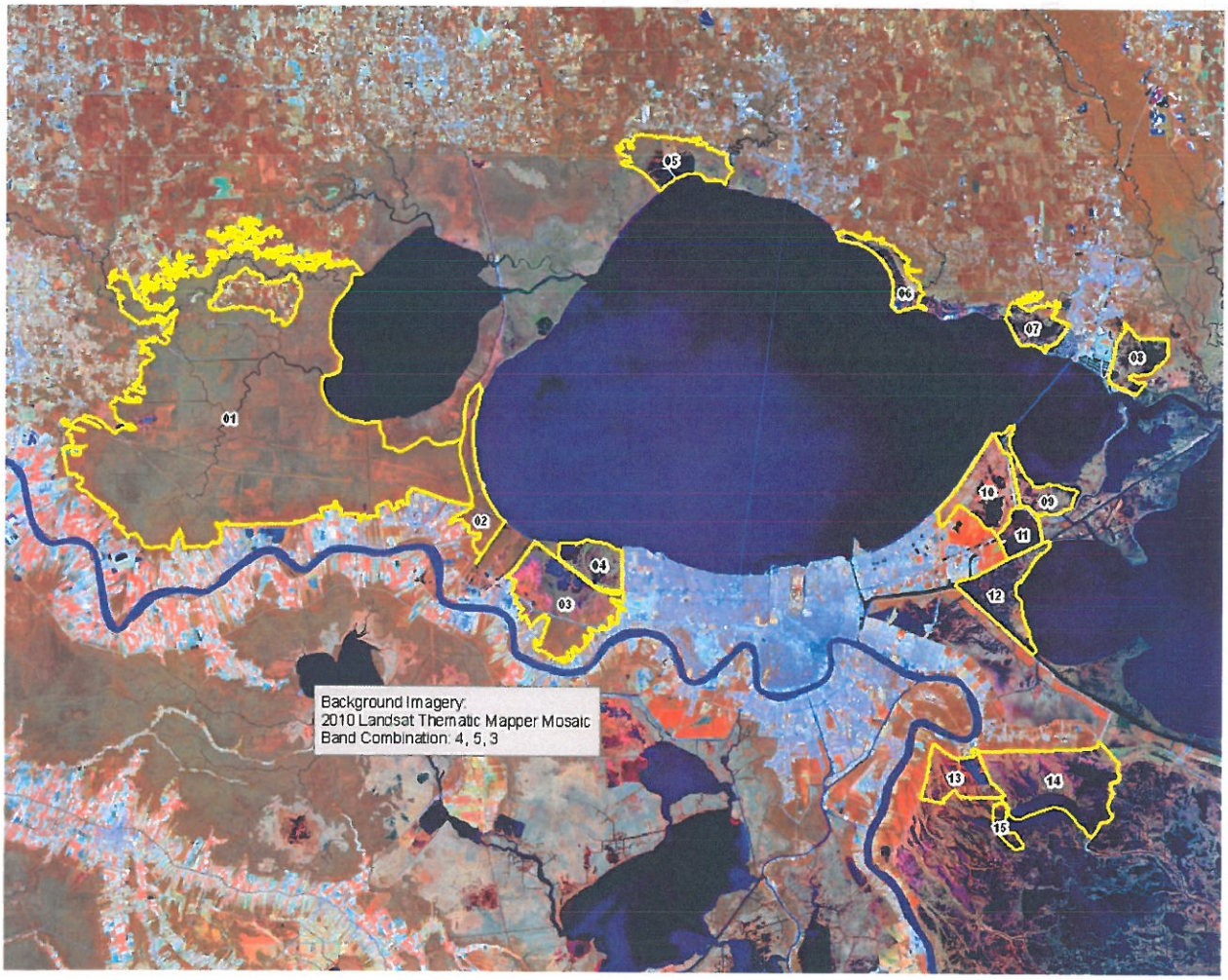
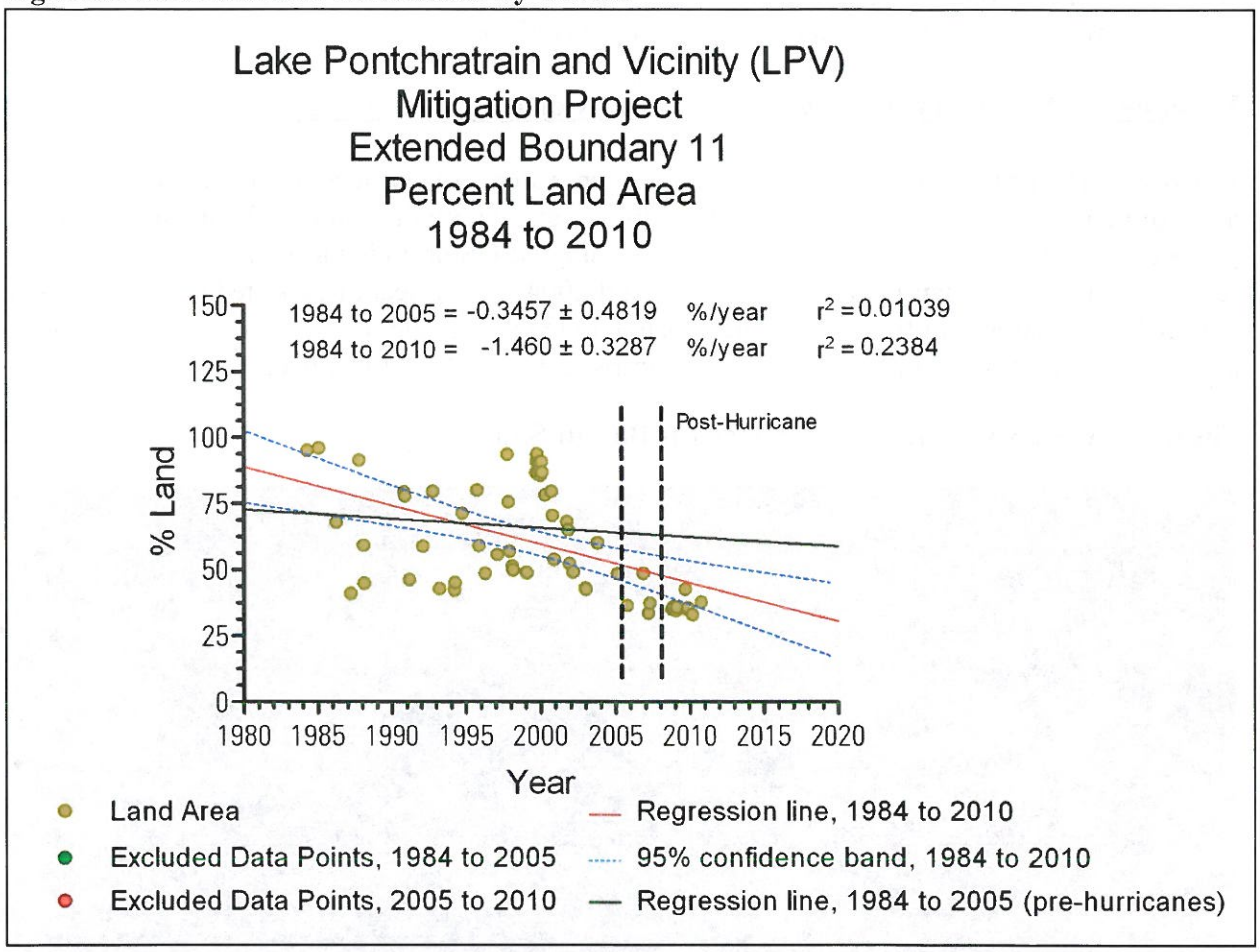


Figure 3. Land loss rate determined by USGS.



The Fish and Wildlife Service calculated land loss rate using the same USGS Land/Water data, but with a different regression (Land Acres : Time). That rate was used to calculate land/water values over the life of the project.

Extended Boundary Percent Loss Rate = -0.0179

Project Area Acre per year lost rate

FWOP = -2.31

FWP (but rate reverts back to FWOP rate when water level rise/vertical acrretion equals 10 inches) = -1.16

FWOP – Assuming the USGS background (low RSLR) loss rate and the time before project implementation, the 8.6 acres existing marsh will be lost by TY1 and no new marsh is expected because water levels are not drawn down to a level that would allow natural vegetation growth.

TY 0

Marsh	1.45 acres (1%)
Water	127.94 (99%)

TY1 – TY50

Marsh:	0 acres (0)%
Water:	129.4 acres (100%)

FWP – Created marsh platform has limited marsh function until settlement and breaching of retention dikes. Landloss is applied at the time of marsh creation. The rate is 50% of the background loss rate until TY28 when at least10 inches of water is assumed to cover the marsh and background loss rate is resumed. Percent is of the entire project area acreage.

TY0

Marsh:	1.45 acres (1%)
Water:	127.94 acres (99%)

TY1

Non-functional Marsh platform:	116.5acres (90%)
Marsh:	12.9 acres (10% [0.1 credit factor applied])
Water:	0 acres (0%)

TY3

Non-functional Marsh platform:	95.9 acres (73%)
Marsh:	31.2acres (25% [0.25 credit factor applied])
Water:	2.31 acres (2%)

TY5

Non-functional Marsh platform:	0 acres (0%)
Marsh:	124.8 acres (96% - assume all existing created marsh platform converted to marsh [full credit; 1.0 credit factor])
Water:	4.6 acres (4%)

TY 6

Marsh:	123.6 acres (96%)
Water:	5.79 acres (4%)

TY28

Marsh	97 acres (75%)
Water:	32.4 acres (25%)

TY50

Marsh:	46.1 acres(36%)
Water:	83.3 acres (64%)

Variable V_2 - Percent of open water covered by aquatic vegetation

Existing Conditions – There is no SAV, only open water. The project area contained only small marsh fragments in 1998 and by 2005 there was no vegetation. Water level is controlled by water control structures with an operation schedule in place that so far has not enhanced aquatic vegetation cover.

FWOP – Existing conditions are expected to persist.
TY 0 – 50: 0%

FWP – When the marsh land platform is constructed, all open water will be eliminated. Until the created marsh platform settles to marsh elevation and the retention dikes are breached, it is assumed that very little open water, or SAV volunteers exists to support SAV growth.

TY0	0%
TY1:	0%
TY3:	0%
TY5:	0% (100% of baseline)
TY6:	15% (increase baseline by 15%)
TY28:	15% (increase baseline by 15%)
TY50:	0% (25% of baseline; a 75% loss from baseline)

Variable V_3 - Marsh edge and interspersion

Existing Conditions – There is only about 8 acres of marsh on the southern boundary with 121 acres of open water.

FWOP – Existing conditions will persist.
TY 0 – 50: 100% Class 5

FWP –

TY 0:	100 % Class 5
TY 1	100% Class 5
TY 3	100% Class 3 ("carpet marsh")
TY 5	50% Class 3, 50% Class 1
TY 6	100% Class 1
TY 28	15% Class 1, 85% Class 2
TY 50	100% Class 3

Variable V_4 - Percent of open water area <=1.5 feet deep in relation to marsh surface

Existing Conditions - Although projected RSLR estimates predict a sea-level rise of approximately 2.0 feet for the year 2063 under the Intermediate RSLR scenario, the water level in the impoundment is a function of three factors: Rainfall, a variable(?) stoplog structure at the west end, and operation of a 48 inch pump on the east boundary of the impoundment, adjacent to the HSDRSS levee. Approximately 10 days are required to remove 1 inch of water (BSNWR management; persn.com). Therefore, the project area should not be affected by sea level rise during the 50 year project life/analysis period. It was assumed that RSLR will reduce the existing shallow open water for FWOP and FWP at TY50 by 1/3 and 1/6 respectively. Water depth measurements collected on 6 April 2011, indicated that the area has no open water that is <= 1.5 feet.

FWOP

TY0	0%
TY1	0%
TY3	0%
TY5	0%
TY6	0%
TY25	0%
TY50	0%

FWP- The existing hydrologic control of the impounded south unit would continue according to the BSHR CWPPRA project; however, the mitigation project land platform would be built to a subaerial elevation with dredged material. After the retention dikes are gapped or degraded it is expected that the area could be temporarily inundated because of rainfall raising the water level in the impoundment. The water control structures mentioned previously would drain the water after some time to levels prescribed by the CWPPRA project plan, which presumably would periodically allow complete drainage of the marsh creation area. Marsh that is lost is assumed to become open water <= 1.5 feet deep until TY50. At that point, it is assumed that 1/6 of the shallow open water would become deeper than 1.5 feet.

TY0	0%
TY1	100%
TY3	100%
TY5	100%
TY6	100%
TY28	100%
TY50	83%

Variable V_5 - Salinity

Existing conditions - The water within the impoundment has variable salinities. Also, if the proposed borrow areas in Lake Pontchartrain and Lake Borgne were utilized brackish water and sediment may be introduced into the project area. The rate of evaporation and rainfall control the water salinity. Currently estimates for salinity in the area are only available from the north

unit (CRMS4107). The mean salinity recorded by that station for the 2010 growing season was 3.6 ppt. Water from this unit can flow into the south unit over a fixed-crest weir when water levels rise due to rainfall input.

FWOP & FWP
TY0 – TY50 3.6 ppt; possibly higher after dredged material added.

Variable V_6 – Aquatic organism access

Existing conditions – 100 % of the project area is impounded and water can only flow out through the water control structures; therefore, there is no access to any areas outside of the impoundment levees

FWOP -Existing conditions are expected to persist.
TY0-TY50: 0.0001

FWP Existing conditions are expected to persist.
TY0 – TY50: 0.0001

Literature Cited

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

Trahan, Larry. 1987. Soil Conservation Service Soil Survey of Orleans Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

U.S. Fish and Wildlife Service 1991. Bayou Sauvage National Wildlife Refuge Wetland Restoration: Candidate Project for the Priority Project List of the Coastal Wetlands, Planning, Protection, and Restoration Act. Slidell, La: USFWS. 16 pp.

U.S. Fish and Wildlife Service 1994. Final Environmental Impact Statement: Bayou Sauvage National Wildlife Refuge. Slidell, La.: USFWS. 614 pp.

Wetland Value Assessment Project Information Sheet

June 2011

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

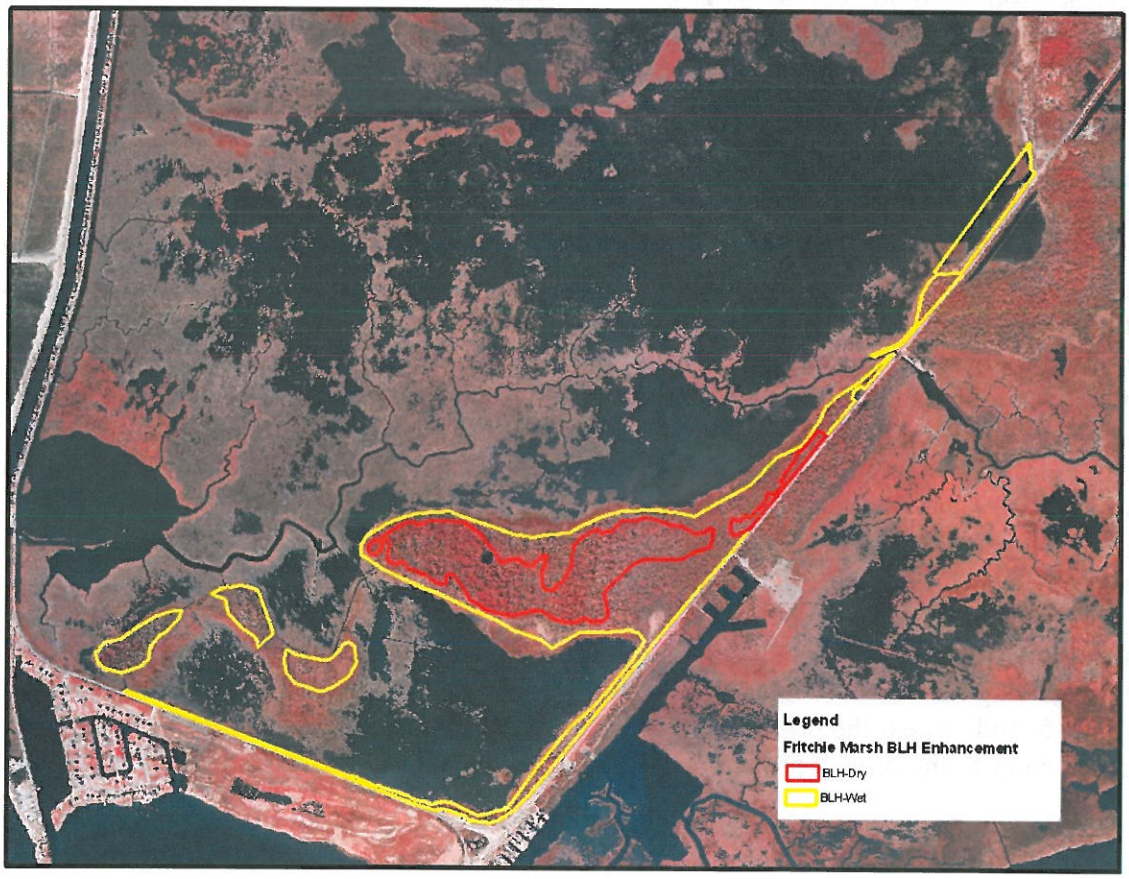
Project Name: LPV HSDRRS Mitigation- Fritchie Marsh BLH (wet) Enhancement

Mitigation Potential: 0.20 AAHUs/acre

Project Type(s): BLH Enhancement

Project Area: The project area is located southeast of Slidell and north of the Rigolets Pass in St. Tammany Parish, Louisiana. The enhancement area is on Prevost Island a chenier ridge that is surrounded by the Fritchie Marsh complex. U.S. Highway 90 traverses the ridge along the southeastern edge.

Figure 1. Project Area



Project Goal
In the proposed project area, invasive species eradication and reforestation (where applicable) would be performed. This entails removal of undesirable vegetation, ringing of trees, and the application of required herbicide treatment. Healthy existing BLH species should remain on the site. Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large "gaps" in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted. For the areas to be enhanced, no changes in rainfall runoff are expected.

Habitat Assessment Method
The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for BLH habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Surrogate Sites
The following information/data for WVA purposes was obtained from off-site locations (i.e., Plots 2, 5, and 7) near the project site. Those sites were utilized because we were not granted right of entry to the project property by the landowner. The surrogate sites are located adjacent

to the project area and were, therefore, subjected to similar wind/flooding conditions during Hurricane Katrina.

Variable V_1 – Stand Structure

Existing – The forest is an early successional, nearly monoculture of young Chinese tallow-tree. The area was heavily damaged by Hurricane Katrina. A few standing stressed or dead live oak remain; indicating that some oaks and possibly other hardmast species were present before that storm. It is likely that most of the existing vegetation will require grubbing and removal.

FWOP – The forest is expected to mature, but with limited wildlife value because of domination by Chinese tallow-tree and the death of existing stressed live oaks.

TY0	Class 5	Field investigation indicated 100% of overstory canopy consists of hardmast.
TY1	Class 5	
TY20	Class 1	Chinese tallow previously present in the midstory is expected to dominate the canopy at this time. In addition, assume death of previously existing stressed live oaks by this TY.
TY50	Class 1	The forest is expected to remain heavily dominated by Chinese.

FWP – Service BLH mitigation guidelines suggest that the entire acreage be planted with mast-producing species suited to the soil(s) and site conditions. Mid-story species (i.e., shrub species) could include mayhaw, hawthorn, and persimmon. Planting of mast-producing species would be on by 9-foot x 9-foot centers (538/acre) and mid-story species on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees. Hard to soft mast tree species ratio should range between 60 and 70 hardmast species to 30-40 softmast species.

TY0	Class 5	Field investigation indicated 100% of overstory canopy consists of hardmast.
TY1	Class 5	As planted assuming a 60:40 (hardmast to softmast) ratio, but not full functional value; not mature canopy
TY20	Class 5	Assume full functional forest
TY50	Class 5	Assume full functional forest

Variable V_2 – Stand Maturity

Existing Conditions – The storm surge from Hurricane Katrina in 2005 inundated the project area, as well as the data collection sites. The combination of salinity introduction, storm surge energy, flooding duration, and wind killed most of the vegetation.

FWOP

TY0 dbh = 17.25
TY1 dbh = 17.5

TY20 dbh = 7.3 decline due to assumed death of stressed canopy live oaks by this TY – tallow previously present in midstory now dominate the overstory

TY50 dbh = 15.1

FWP – Seedlings are assumed to be planted and have one year of growth at TY1.

TY0 dbh = 17.25
TY1 dbh = 17.5 due to existing live oaks in the canopy
TY20 age = 20 assume death of stressed canopy live oaks by this TY
TY50 age = 50

Variable V_3 - Understory / Midstory

FWOP

TY0 40/80 (understory/midstory) based on field observations at surrogate sites
TY1 40/80
TY20 30/30
TY50 30/30

FWP – It is suggested that some shrub/scrub species (e.g., mayhaw, hawthorn, and persimmon) be planted on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees to ensure diversity within the forest.

TY0 40/80 (understory/midstory)
TY1 100/0
TY20 25/60
TY50 30/30

Variable V_4 - Hydrology

Existing – The major soil types in the project area are Abita and Guyton. Abita soil has a seasonally high water table fluctuates between depths of about 1 to 3 feet from December through April. Adequate water is available to plants in most years. The Guyton soil is at a lower position on the landscape with seasonal high water table ranging from the surface to a depth of 1.5 feet from December to May. The soil is subject to infrequent flooding (2x in 5 years) for very brief to long periods any time of the year, and are subject to tidal flooding.

FWOP and FWP – Existing conditions will persist. With a 1.3 foot SLR some areas may experience increased tidal flooding but should not extend throughout the growing season.

Prevost Island has elevations ranging from 2 to 6 feet according to the USGS National Elevation Database (2001), and the majority of BLH-Wet enhancement project area occurs on elevations ranging from 3 to 5 feet. Assuming a 1.3 foot rise in water levels, it can be expected that the site will be 1.7 to 3.7 feet above water level by the end of the project life.

TY0 temporary/low (flooding duration/flow)
TY1 temporary/low
TY20 temporary/low
TY50 temporary/low

Variable V_5 - Size of Contiguous Forested Area

FWOP: The contiguous forest is Class 4 (i.e., 250-400 acres).

FWP: The contiguous forest is Class 4 (i.e., 250-400 acres).

Variable V_6 – Suitability and Traversability of Surrounding Land Uses

FWOP

BLH/Marsh = 59%
NonHabitat = 3%
Water = 38%

FWP - Assuming the Fritchie Marsh Creation project is built.

BLH/Marsh = 82%
NonHabitat = 3%
Water = 15%

A development rate was not applied to this area. Much of the surrounding land use will be part of the BSNWR after project construction and new development is not expected because of decreased population and business resulting from Hurricane Katrina. Also, impact assessments were evaluated with the assumption that no development rate increase would be realized through the life of the project.

Variable V_7 – Disturbance

FWOP & FWP

The project area is adjacent to U.S. Highway 90 (i.e., a major highway), therefore, assume Distance – Class 1 and Type – Class 1.

TY0 Class 1/1 (distance/type)
TY1 Class 1/1
TY20 Class 1/1
TY50 Class 1/1

Appendix F

"Guidelines – Wet BLH Habitat Enhancement, Swamp Habitat Restoration, and Swamp Habitat Enhancement" Document

And

"Draft Standardized Assumptions for Marsh" Document

GUIDELINES –
WET BOTTOMLAND HARDWOOD HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT

Planting Guidelines for Wet Bottomland Hardwood Habitat Enhancement

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 20-foot centers (average) to achieve a minimum initial stand density of 109 seedlings per acre. Stock will be at least 1 year old, at least 2 feet in height, and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings will be installed in a manner that that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as chicken-wire fencing or plastic seedling protectors will be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Tables 1A and 1B. Plantings will be conducted such that the total number if plants installed in a given area consists of approximately 60% hard mast-producing species (Table 1A) and approximately 40% soft mast-producing species (Table 1B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 1A and 1B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in Tables 1A and 1B. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 2. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large "gaps" in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The initial enhancement actions involved within a particular mitigation site could include a variety measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described above. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings, and/or the species to be planted, and/or the percent composition of planted species. Similarly, areas that must be re-planted due to failure in achieving applicable mitigation success criteria may involve cases where the general guidelines discussed above will not necessarily be applicable.

Given these uncertainties, initial planting plans specific to the mitigation site will be required and must be specified in the Mitigation Work Plan for the site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared

and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required 1 year following completion of initial plantings), the Sponsor will be responsible for preparing re-planting plans and conducting re-planting activities. Re-planting necessary to achieve the initial survivorship criteria will be the responsibility of the USACE.

Table 1A: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (60% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli*	20% - 30%
Willow oak	*Quercus phellos*	20% - 30%
Water oak	*Quercus nigra*	20% - 30%
Overcup oak	*Quercus lyrata*	10% - 20%
Swamp chestnut oak	*Quercus michauxii*	10% - 20%
Bitter pecan	*Carya x lecontei*	10% - 20%
Water hickory	*Carya aquatica*	10% - 20%

Table 1B: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (40% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	15% - 25%
Sugarberry	*Celtis laevigata*	15% - 25%
Green ash	*Fraxinus pennsylvanica*	15% - 25%
Sweetgum	*Liquidambar styraciflua*	10% - 20%
American elm	*Ulmus americana*	10% - 20%
Slippery elm	*Ulmus rubra*	10% - 20%
White ash	*Fraxinus americana*	5% - 15%
Bald cypress	*Taxodium distichum*	5% - 15%

Table 2: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Saltbush	*Baccharis halimifolia*	TBD
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Common persimmon	*Diospyros virginiana*	TBD
Honey locust	*Gleditsia triacanthos*	TBD
Possumhaw	*Ilex decidua*	TBD
Yaupon	*Ilex vomitoria*	TBD
Red mulberry	*Morus rubra*	TBD
Wax myrtle	*Myrica cerifera*	TBD
Swamp bay	*Persea palustris*	TBD
Dwarf palmetto	*Sabal minor*	TBD

TBD = To Be Determined

Planting Guidelines for Swamp Habitat Restoration and Swamp Habitat Enhancement

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 20-foot centers (average) to achieve a

minimum initial stand density of 109 seedlings per acre. Stock used for canopy species will be at least 1 year old, at least 3 feet tall, and have a root collar diameter that exceeds 0.5 inch. Stock used for midstory species will be at least 1 year old and will be at least 3 feet tall. All stock must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events may delay plantings until late spring or early summer. The seedlings will be installed in a manner that that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as chicken-wire fencing or plastic seedling protectors will be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Table 3. The species composition of the plantings should mimic the percent composition guidelines indicated in this table. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in Table 3. In general, a minimum of 3 canopy species should be utilized, the plantings must include baldcypress and tupelogum, and baldcypress should typically comprise at least 50% of the total number of seedlings installed.

The midstory species installed will be selected from the species list provided in Table 4. Plantings will consist of at least 2 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

For swamp enhancement projects that include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large "gaps" in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The initial enhancement actions involved within a particular swamp enhancement mitigation site could include a variety measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described above. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings, and/or the species to be planted, and/or the percent composition of planted species. Similarly, areas that must be re-planted due to failure in achieving applicable mitigation success criteria may involve cases where the general guidelines discussed above will not necessarily be applicable.

Given these uncertainties, initial planting plans specific to a mitigation site will be required and must be specified in the Mitigation Work Plan for the site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required 1 year following completion of initial plantings), the Sponsor will be responsible for preparing re-planting plans and conducting re-planting activities. Re-planting necessary to achieve the initial survivorship criteria will be the responsibility of the USACE.

Table 3: Preliminary Planting List for Swamp Habitat, Canopy Species

Common Name	Scientific name	Percent Composition
Bald cypress	*Taxodium distichum*	50% - 65%
Tupelogum	*Nyssa aquatic*	20% - 25%
Green ash	*Fraxinus pennsylvanica*	10% - 15%
Drummond red maple	*Acer rubrum* var. *drummondii*	5% - 10%
Bitter pecan	*Carya aquatic*	5% - 10%

Table 4: Preliminary Planting List for Swamp Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Swamp privet	*Forestiera acuminata*	TBD
Possumhaw	*Ilex decidua*	TBD
Virginia willow	*Itea virginica*	TBD
Wax myrtle	*Myrica cerifera*	TBD
Swamp rose	*Rosa palustris*	TBD
Snowbell	*Styrax americana*	TBD

TBD = To Be Determined

Guidelines for the Eradication and Control of Invasive and Nuisance Plant Species

The eradication of invasive and nuisance plant species may incorporate a variety of eradication methods including mechanized removal (ex. hydroaxes, gyro-tracs, heavy machinery used in areas slated for topographic alterations), non-mechanized removal (use of hand implements such as chain saws and machetes, with subsequent herbicide applications, direct uprooting by hand), and directed herbicide applications. Regardless of the methods involved, care will be exercised to avoid damage to desirable native species to the greatest extent practicable. During the initial eradication process, larger quantities of felled materials will generally be removed from the mitigation site and disposed in a duly-licensed facility. Some felled woody plants may be chipped on-site; however chipping will be avoided unless deemed necessary to best preserve desirable vegetation and provide for re-growth of desirable plants. Where chipping is employed, chips will be segregated into a limited number of scattered piles rather than spreading the chips. Felled woody plants may also be gathered and stacked "teepee" style in scattered locations. In certain cases, larger invasive trees may be killed and allowed to remain standing if it is determined this would not interfere with mitigation goals. The Mitigation Work Plan must address the specific measures proposed to conduct initial eradication efforts and the recommended measures for the subsequent control of invasive and nuisance plant species.

The USACE will be responsible for the initial eradication of invasive and nuisance plants as well as for any subsequent eradication efforts necessary to achieve attainment of success criteria 1 year following the completion of the initial eradication activities. Thereafter, the Sponsor will be responsible for the successful control and eradication of invasive and nuisance plant species. The management objectives will be to maintain the mitigation site such that it is essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events.

Guidelines for Clearing, Grading, and Other Earthwork Activities

Enhancement or restoration activities in certain mitigation areas may include alterations to existing topography. This includes an array of potential actions such as lowering grades over relatively large areas,

breaching or removal of existing berms and spoil banks, filling of drainage canals and ditches, construction of containment berms, etc. The construction process could involve mechanized clearing and grubbing of the areas to be graded followed by the actual grading work.

Prior to the clearing, grubbing, grading, and related earthwork activities, the exact limits of zones requiring clearing and grading/earthwork will be determined in the field and will be marked with protective barriers such as flagging, ropes, stakes, silt fence, enviro-fence, or a combination of such items. These marker barriers will remain in place until grading activities are completed. Prior to initiation of the clearing and grading/earthwork activities, silt fences will also be installed at appropriate locations adjacent to existing wetlands to control erosion and sediment transport. These erosion/sediment control devices will remain in place until earthwork activities are completed and the disturbed areas are stabilized. Machinery/vehicle ingress and egress routes to the areas requiring earthwork will be restricted to avoid unnecessary damage to nearby upland and wetland areas.

Cleared vegetation will be removed from the mitigation site for disposal either within a duly licensed off-site disposal facility. Soil removed during the grading/earthwork process will either be disposed off-site in a licensed facility or used within the mitigation site as fill if the material is suitable and fill is needed. All other debris generated during the clearing and grading process will be disposed in a duly-licensed off-site facility.

If grading or other earthwork activities are necessary, the Mitigation Work Plan must include detailed plans depicting the required activities (ex. grading contours, cross-sections, stormwater pollution prevention plans, etc.). These plans will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful completion of all initial earthwork activities. The Sponsor will be responsible for any subsequent earthwork activities necessary for the proper maintenance of the mitigation site. However if the primary purpose of the initial grading/earthwork activities is to enhance site hydrology, then the USACE will be responsible for conducting any additional grading/earthwork activities necessary to ensure the hydrologic enhancement objectives (success criteria) are achieved. Once it is demonstrated that these objectives have been satisfied, the Sponsor will then be responsible for any further earthwork activities needed to ensure proper maintenance.

Guidelines for Surface Water Management Features and Structures

Enhancement or restoration efforts in some mitigation areas may include construction of surface water management systems and/or installation of water conveyance or water control structures (ex. drainage culverts, flap gates, weirs). If such actions are necessary the Mitigation Work Plan must include detailed plans for these activities as well as operational specifications if applicable. These plans and specifications will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful construction of any surface water management features, drainage structures, and water control structures. The Sponsor will be responsible for the subsequent maintenance and operation activities required.

Swamp Hydrology Guidelines

The optimal hydrologic regime for baldcypress/tupelogum (water tupelo) swamps involves both seasonal flooding and good surface water exchange between a particular swamp and adjacent systems. The typical hydroperiod should include several periods of flooding (inundation) and drawdown, or a "pulsing" hydrology. Surface water should be present for extended periods, especially during portions of the growing season, but should be absent (water table at or below the soil surface) by the end of the growing season in most years. At a minimum, standing surface water should be absent for approximately 2 months during the growing season once every 5 years. Abundant and consistent freshwater input from riverine systems is most desirable, as is relatively consistent surface water flow through the swamp during flooded periods. However, other sources of sheetflow into the swamp can be similarly beneficial. The main objective is to have good surface water exchange between the swamp and adjacent habitats. Situations involving permanent flooding and/or no surface water exchange should be avoided when possible.

The following provides some general hydrologic guidelines for mitigation projects involving swamp restoration and for those mitigation projects involving swamp enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program.

- Strive for a minimum of about 200 consecutive days but no more than roughly 300 consecutive days of inundation (flooding). This period of inundation should overlap a portion of the growing season (preferably the early portion or late portion).
- Strive for a minimum of roughly 40 to 60 consecutive days during the growing season where the water table is at or below the soil surface (i.e. non-inundated period). This non-inundated period should preferably occur during the middle portion of the growing season. The non-inundated period should not exceed approximately 90 to 120 days.
- Strive to achieve an average maximum (peak) water table elevation that ranges between approximately 1.0 feet to 2.0 feet above the soil surface (i.e. depth of average peak inundation is 1.0 to 2.0 feet). Water table elevations greater than 2 feet above the soil surface may occur, however such occurrences should be of relatively short duration (i.e. brief "spikes" in the depth of inundation).
- Locate the mitigation area such that it naturally receives freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the swamp and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the swamp's hydroperiod.

Wet Bottomland Hardwood Hydrology Guidelines

The optimal hydrologic regime for wet bottomland hardwood (BLH) forests also involves both brief seasonal flooding and good surface water exchange between the forest and adjacent systems. Wet BLH forests are commonly flooded for some portion of the year, although the timing, extent, depth, duration, and source of floodwaters can be highly variable. The hydroperiod commonly includes temporary flooding for brief periods during the growing season; however the water table is typically below the soil surface for the majority of the growing season. When flooding (inundation) does occur, freshwater input from riverine systems is most desirable as is relatively consistent surface water flow through the forest. Having good surface water exchange between the BLH forest and adjacent habitats is the primary objective, thus other sources of sheetflow into the forest besides riverine sources can be similarly beneficial.

The following provides some general hydrologic guidelines for mitigation projects involving BLH habitat restoration and for those mitigation projects involving BLH habitat enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program.

- Avoid extended periods of inundation, particularly during the early portion of the growing season. Brief periods of flooding typically should occur during the winter and early spring, but the water table should be greater than 1 foot below the soil surface for an extended period during the growing season.
- The hydroperiod should be such that the forest is irregularly inundated or soils are saturated to the soil surface for a period ranging from approximately 15 to 30 days during the growing season.
- Locate the mitigation area such that it naturally receives occasional freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the BLH forest and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the forest's hydroperiod.

WET BOTTOMLAND HARDWOOD HABITAT ENHANCEMENT – MITIGATION SUCCESS CRITERIA

General Construction

As applicable, complete all necessary initial earthwork and related construction activities by the end of Mitigation TY1 (2014). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems.

Native Vegetation

Complete initial planting of canopy and midstory species.

1 Year Following Completion of Initial Plantings (at end of first growing season following plantings) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 266/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan (composition = 60% hard mast, 40% soft mass; percentages = see planting table). These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 93/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.

4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 300 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 120 living, native, hard mast-producing species in the canopy stratum but no more than approximately 150 living hard-mast producing species in the canopy stratum (planted trees and/or naturally recruited native canopy species). The remaining trees in the canopy stratum must be comprised of soft-mass producing native species. These criteria will thereafter remain in effect for the duration of the overall monitoring period.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

Within 10 Years Following Completion of Initial Plantings –

- Attain a minimum average cover of 80% by planted canopy species and/or naturally recruited native canopy species. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

15 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species).

25 Years Following Completion of Initial Plantings –

- Average cover by native species in the midstory stratum must be greater than 20% but cannot exceed 50%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum must be greater than 30% but cannot exceed 60%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

Invasive and Nuisance Vegetation

Complete the initial eradication of invasive and nuisance plant species.

Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will be made 15 years following completion of initial plantings. If it is decided that timber management efforts are necessary, the Sponsor will develop a Timber Stand Improvement/Timber Management Plan in coordination with the USACE and Interagency Team and, following approval of the plan, will perform the necessary thinning operations.

Hydrology

In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days.

If the mitigation program includes actions intended to enhance site hydrology or hydroperiod, demonstrate that the affected site is irregularly inundated or soils are saturated to the soil surface for a period ranging from 7% to approximately 13% of the growing season during a year having essentially normal rainfall. The Mitigation Work Plan for a specific site may establish more specific hydrologic enhancement goals. If this is the case, demonstrate attainment of the specific goals identified in the plan.

WET BOTTOMLAND HARDWOOD HABITAT ENHANCEMENT – MITIGATION MONITORING GUIDELINES

"Time Zero" Monitoring Report ---

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

A detailed discussion of all mitigation activities completed.

A description of the various features and habitats within the mitigation site.

A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations.

A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species, but some may also be located in areas where plantings are not needed.

Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). The permanent monitoring plots will be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Typically there will be at least one monitoring plot for every 20 acres planted.

Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average height of native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).

Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be

established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will specify be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native subcanopy species; composition of native subcanopy species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. Data (water table elevations) will be collected at least bi-weekly. Once the monitoring indicates the water table may be rising to an elevation that would meet hydrologic success criteria, water table elevations will be collected on a daily basis until it is evident the success criteria has been satisfied. The schedule of water table elevation readings can shift back to a bi-weekly basis for the remainder of the monitoring period. The number of piezometers and staff gages required as well as the locations of these devices will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Once hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

Brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities ---

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the Interagency Team, monitoring will be required in the year immediately preceding and in the year following completion of the timber management activities (i.e. pre-timber management and post-timber management reports). These reports must include data and information that are in addition to the typical monitoring requirements. The Sponsor's proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that will be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the Interagency Team prior to the monitoring events and implementation of the timber management activities.

Monitoring Reports Following Re-Planting Activities ---

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include an inventory of the number of each species planted and the stock size used. It must also

include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

WET BOTTOMLAND HARDWOOD HABITAT ENHANCEMENT – MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place during the spring of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE and to agencies comprising the Interagency Team. Table 5 lists the years monitoring events are anticipated to be conducted and monitoring reports submitted in conjunction with these events. It also indicates the party responsible for conducting the monitoring and preparing the monitoring report for each year.

Table 5: Anticipated Mitigation Monitoring Schedule

Year of Monitoring		Monitoring Responsibility
Mitigation Target Year	Calendar Year	
0	2013	N/A (start of mitigation work)
2	2015	USACE (time zero monitoring)
3	2016	USACE
6	2019	Sponsor
9	2022	Sponsor
12	2025	Sponsor
17	2030	Sponsor
22	2035	Sponsor
27	2040	Sponsor
32	2045	Sponsor
37	2050	Sponsor
42	2055	Sponsor
47	2060	Sponsor
52	2065	Sponsor (final monitoring)

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). The USACE will be responsible for conducting this additional monitoring and preparing the monitoring reports. Similarly, if the native vegetation success criteria specified for 4 years following completion initial plantings are not achieved, a monitoring report will be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied. The Sponsor will be responsible for conducting this additional monitoring and preparing the monitoring reports.

The two scenarios above are not accounted for in Table 5. This table also does not account for additional monitoring events and reports associated with any timber management activities. If such activities are conducted, the Sponsor will be responsible for conducting the additional monitoring and preparing the associated monitoring reports (pre-timber management and post-timber management reports).

Once monitoring responsibilities have transferred to the Sponsor, the Sponsor will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially (by as much as 50%) if it is clear that mitigation success is

proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

SWAMP HABITAT ENHANCEMENT & RESTORATION – MITIGATION SUCCESS CRITERIA

The success criteria specified herein apply to both swamp restoration projects and swamp enhancement projects unless otherwise indicated.

General Construction

As applicable, complete all necessary initial earthwork and related construction activities by the end of Mitigation TY1 (2014). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems.

Native Vegetation

Complete initial planting of canopy and midstory species.

1 Year Following Completion of Initial Plantings (at end of first growing season following plantings) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 266/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 93/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.

4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 125 living baldcypress trees (planted trees and/or naturally recruited native canopy species). The species composition of the additional native canopy species present must be generally consistent with the planted ratios for such species. These criteria will thereafter remain in effect for the duration of the overall monitoring period.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

Within 15 Years Following Completion of Initial Plantings –

- Achieve one of the two following vegetative cover requirements:

    1. The average percent cover by native species in the canopy stratum is at least 50%, <u>and</u>; the average percent cover by native species in the midstory stratum exceeds 33%, <u>and</u>; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
    2. The average percent cover by native species in the canopy stratum is at least 75%, and: (a) the average percent cover by native species in the midstory stratum exceeds 33%, or; (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.

- Following attainment of one of the above criteria, the requirement to satisfy one of the two criteria specified above will thereafter remain in effect for the duration of the overall monitoring period.

Within 45 Years Following Completion of Initial Plantings –

- Demonstrate that the average diameter at breast height (DBH) of living baldcypress trees exceeds 16 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average DBH of the other living native trees in the canopy stratum (trees other than baldcypress) exceeds 12 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average total basal area accounted for by all living native trees in the canopy stratum combined exceeds approximately 161 square feet per acre. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

Invasive and Nuisance Vegetation

Complete the initial eradication of invasive and nuisance plant species.

Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will likely be made after it is demonstrated that the average total basal area accounted for by living native canopy species exceeds 170 square feet per acre. If it is decided that timber management efforts are necessary, the Sponsor will develop a Timber Stand Improvement/Timber Management Plan in coordination with the USACE and Interagency Team and, following approval of the plan, will perform the necessary thinning operations.

Hydrology

The following applies to mitigation areas involving swamp restoration and to those involving swamp enhancement where hydrologic enhancement is a component of the mitigation program.

In a year having essentially normal rainfall, demonstrate compliance with each of the following criteria:

- Achieve inundation of the majority of the mitigation area for a minimum of 200 consecutive days but for no more than approximately 300 consecutive days, preferably with periods of inundation overlapping a portion of the growing season.
- Achieve non-inundation of the majority of the mitigation (water table at or below the soil surface) for a minimum of approximately 60 consecutive days but for no more than approximately 90 consecutive days, preferably during the period from June through August.
- The average maximum (peak) water table elevation must range between approximately 1.0 feet to 2.0 feet above the soil surface.

Note that the specific mitigation work program generated for the mitigation area may include deviations from one or more of the above criteria to better reflect the desired wetland hydroperiod. Such deviations must be approved by the USACE in coordination with the Interagency Team, and would supersede the above criteria once approved.

The following applies to swamp enhancement mitigation areas where hydrologic enhancement is not a component of the mitigation program.

- In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days.

SWAMP HABITAT ENHANCEMENT & RESTORATION –
MITIGATION MONITORING GUIDELINES

"Time Zero" Monitoring Report ---

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

A detailed discussion of all mitigation activities completed.

A description of the various features and habitats within the mitigation site.

A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations.

A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species. For mitigation involving swamp enhancement, some photo stations may also be located in areas where plantings are not needed.

Quantitative plant data collected from permanent monitoring plots measuring approximately 80 feet X 80 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the

species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre. The permanent monitoring plots will typically be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan.

Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from permanent sampling quadrats nested within the permanent monitoring plots described above. There will be a total of 4 quadrats with each quadrat measuring approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will specify be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. The number of piezometers and staff gages required as well as the locations of these devices will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data (water table elevations) will be collected at least bi-weekly throughout the year. For mitigation areas involving swamp enhancement where hydrologic enhancement is not a component of the mitigation program, it may also be necessary to collect water table elevations on a daily basis over the course of 3 to 4 weeks in order to demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days during the growing season. Once it is demonstrated that all applicable hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and ground cover strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species; general observations regarding the growth of non-planted native species in the canopy and midstory strata. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

Brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities ---

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the Interagency Team, monitoring will be required in the year immediately preceding and in the year following completion of the timber management activities (i.e. pre-timber management and post-timber management reports). These reports must include data and information that are in addition to the typical monitoring requirements. The Sponsor's proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that will be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the Interagency Team prior to the monitoring events and implementation of the timber management activities.

Monitoring Reports Following Re-Planting Activities ---

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

SWAMP HABITAT ENHANCEMENT & SWAMP HABITAT RESTORATION – MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place during the summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE and to agencies comprising the Interagency Team. Table 6 lists the years monitoring events are anticipated to be conducted and monitoring reports submitted in conjunction with these events. It also indicates the party responsible for conducting the monitoring and preparing the monitoring report for each year.

Table 6: Anticipated Mitigation Monitoring Schedule

Year of Monitoring		Monitoring Responsibility
Mitigation Target Year	Calendar Year	
0	2013	N/A (start of mitigation work)
2	2015	USACE (time zero monitoring)
3	2016	USACE
6	2019	Sponsor
9	2022	Sponsor
12	2025	Sponsor
17	2030	Sponsor
22	2035	Sponsor
27	2040	Sponsor
32	2045	Sponsor
37	2050	Sponsor
42	2055	Sponsor
47	2060	Sponsor
52	2065	Sponsor (final monitoring)

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). The USACE will be responsible for conducting this additional monitoring and preparing the monitoring reports. Similarly, if the native vegetation success criteria specified for 4 years following completion initial plantings are not achieved, a monitoring report will be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied. The Sponsor will be responsible for conducting this additional monitoring and preparing the monitoring reports.

The two scenarios above are not accounted for in Table 6. This table also does not account for additional monitoring events and reports associated with any timber management activities. If such activities are conducted, the Sponsor will be responsible for conducting the additional monitoring and preparing the associated monitoring reports (pre-timber management and post-timber management reports).

Once monitoring responsibilities have transferred to the Sponsor, the Sponsor will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially (by as much as 50%) if it is clear that mitigation success is proceeding as anticipated. However, any monitoring event used to document attainment of DBH and basal area success criteria for the canopy stratum must employ all applicable monitoring plots and transects called

for at the start of the mitigation monitoring program. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following section.

Invasive Plant Species
All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> U.S. Gelogical Survey. 2011. NAS – Nonindigenous Aquatic Species, Louisiana.
> Website - http://nas.er.usgs.gov/queries/SpeciesList.aspx?group=Plants&state=LA&Sortby=2

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazil vervain (*Verbena litoralis* var. *brevibrateata*), and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Examples of potential nuisance plant species include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), black willow (*Salix nigra*), and boxelder (*Acer negundo*). The determination of whether a particular plant species should be considered as a nuisance species and therefore eradicated or controlled will be determined by the USACE in coordination with the Interagency Team, based on conditions present within a particular mitigation area.

Native Plant Species
This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

USACE Hydrophytic Vegetation Criteria
Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

> USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

Wetland Indicator Status of Plant Species
The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference, using the Region 2 listing contained therein:

> Reed, P. B., Jr. 1988. National List of Plant Species that Occur in Wetlands: 1988 National Summary. Biological Report 88(24). Washington, DC: U.S. Fish and Wildlife Service.
> (website - http://www.usace.army.mil/CECW/Documents/cecwo/reg/plants/list88.pdf)

However, if the USACE approves and adopts a new list in the future, then the currently approved list will apply.

Growing Season
As used herein, the growing season is considered to be the period from April through October of any given year.

Planting Season
This is generally considered to be the period from approximately December 15 through March 15, although some deviation from this typical range is allowed.

Point-Centered Quarter Method
A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

> Cottam, Grant and J. T. Curtis. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer
Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes should be constructed in general accordance with the following reference, unless otherwise approved by the USACE:

> U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

DRAFT STANDARDIZED ASSUMPTIONS FOR MARSH
Date: February 2, 2011

These following represents a cut and paste from the standards previously developed by the natural resource agencies, used in the mitigation bank agreements, and since slightly modified through adaptive management under the NOD's civil works program.

A. Performance Standards

In order for the proposed project to be considered acceptable for mitigating wetland impacts, the site vegetation, soils, and hydrology shall be restored such that the site meets wetland criteria as described in the Corps 1987 Wetlands Delineation Manual. Additionally, the following criteria are applicable:

1. INITIAL SUCCESS CRITERIA

Initial placement of dredged material is completed and at least 80 percent of site is within "as-built" or initial construction elevation. Resource agencies will review the sponsor's proposed initial construction elevation, but it will be the sponsor's responsibility to select the initial construction elevation based on the desired post-compaction, "functional marsh" elevation identified by the natural resource agencies.

2. YEAR THREE SUCCESS CRITERIA

a. After at least two full years following construction, no less than 90% of the marsh creation site is within the "functional marsh" elevation range to be determined by the natural resource agencies on a project-specific basis (e.g., +1.0 feet NAVD88 to + 1.5 feet NAVD88).

b. At least 80% of the dredge material disposal area should be vegetated.

c. Containment dikes breached and tidal creeks constructed and functioning as determined by the natural resource agencies.

d. At least 80% of the vegetative cover is species classified as Facultative (FAC) or wetter, as verified by monitoring reports and verified by the natural resource agencies if necessary.

3. YEAR FIVE SUCCESS CRITERIA

a. Five years after construction, at least 75% of the created marsh remains within the "functional marsh" target elevation range.

b. Demonstrated use of the created marsh area by estuarine-dependent marine fishery species (not just forage species) typical of that marsh type as shown by sampling on a quarterly basis during years four and five using cast nets and/or seines in open water within the project area.

c. Observed use of created marsh by wildlife species typically found in natural marsh habitats of similar salinity regime.

B. Reporting Protocols and Monitoring Plan

1. **AS-BUILT REPORTS**
The Corp / Local Sponsor will submit an As-Built Report to the LDWF, NMFS, EPA, and USFWS within one year following completion of each project specific work. The As-Built Report shall contain a survey providing the areal extent of the filled area and the settled grade of the dredged material and adjacent marsh areas. A licensed surveyor shall certify the survey.

2. **MONITORING PROVISIONS**
The Corps / Local agrees to perform all necessary work to monitor on a project specific basis. The monitoring program shall follow the guidelines established below:

   a. **Visual Description:** Visual descriptions shall be provided with each monitoring report by one of the following means.
      i. Photographs of each vegetation plot and hydrology monitoring station [permanent markers shall be established to ensure that the same locations (and view directions) are monitored in each monitoring period]; or,
      ii. One color aerial photograph (8" x 10" or larger) depicting the entire site. An aerial photograph should be taken once the site has been constructed, stabilized and planted (preferably in the 3rd or 5th year following completion of initial work).

   b. **Hydrology:**
      i. Tidal influence shall be discussed using indicators of high and low tides referenced to a known datum.
      ii. The condition of the constructed tidal channels and ponds noting general flow characteristics, noting excessive scouring and/or silting in of channels.

   c. **Vegetation:**
      i. The Corps / Local Sponsor or designee shall establish survey plots along systematically spaced linear transects (e.g, approximately 20 transects for each marsh cell) at the time of construction, and shall conduct a survey of each tract at or near the end of the first growing season. Surveys shall be conducted in accordance with an accepted academic or industrial sampling methodology (e.g. Steyer et. al. 1995). The State of Louisiana shall establish one-hundredth-acre permanent continuous monitoring plots that account for at least 2 % of the total created marsh area. The species and percentage coverage by species within each plot shall be documented. The State of Louisiana will begin monitoring the continuous monitoring plots and submit monitoring reports to the LDWF, NMFS, EPA, and USFWS at required intervals.
      ii. The Corps / Local Sponsor shall provide a written report to the LDWF, NMFS, EPA, and USFWS that documenting the number and percentage of surviving installed plants. In addition to plant material survivorship, the report shall describe the developing vegetative communities developing within the marsh creation cells by determining:

- Dominant vegetation species;
- A coverage assessment;
- The number and species rated FAC or wetter (excluding FAC-) growing in wetlands (total and #/acre);
- The percentage of dominant species FAC or wetter (excluding FAC-); and
- An invasive/noxious species assessment.

i. The report shall describe the general condition of the vegetation, and discuss likely causes for any observed mortality.

d. Site Elevation: The Corps / Local Sponsor shall provide a topographic survey with elevations shot along the transect lines established for determining plant survivorship, vegetation cover, and species composition. Surveys should be included in monitoring reports for years 1, 3, 5, 10, and 20 for years 1, 3, 5, 10, 20, 30, 40, and 50..

a. Timing:

i. Monitoring shall be conducted during the growing season following years 1, 3, 5, 10 and every 10 years thereafter for 50 years.

ii. Monitoring for the first year or any year following construction shall take place between August and October;

3. MONITORING REPORTS

a. Upon achievement of the initial success criteria, the Corps / Local Sponsor shall document the results of his monitoring in a report submitted to the LDWF, NMFS, EPA, the and USFWS. Additional reports will be submitted following years 3, 5, 10, 20, 30, 40 and 50.

b. The reports shall contain a description of the conditions of the mitigation project relating those conditions to the success criteria and shall contain the following:

i. An aerial photograph (only in report submitted after years one, three and five) taken during the growing season, depicting a completed tract of the mitigation project with the photo date and approximate scale noted.

ii. Ground level photographs.

iii. A detailed narrative summarizing the condition of the mitigation project and all regular maintenance activities.

iv. A drawing based upon the site plan that depicts topography, sampling plots and permanent photo stations.

v. Results of tidal monitoring, including mean high and low water elevations.

vi. Results of vegetation survey including visual estimates of percentage (%) overall cover and % cover by each species, % exotic vegetation, total % "facultative" and total % "upland" species in each vegetation layer, survival rate of planted vegetation (if planted), an estimate of natural re-vegetation, and a qualitative estimate of plant vigor as measured by evidence of reproduction.

vii. If Year 1 success criteria is obtained, but all performance criteria have not been met in the 3rd year, a monitoring report shall be required for each consecutive year until

two annual sequential reports indicate that all criteria have been successfully satisfied (i.e., that corrective actions were successful).

viii. Reports will be submitted by December 31 of each monitoring year.

ix. Monitoring reports shall be provided to the LDWF, NMFS, EPA, and USFWS and made available to other members of the natural resource agencies upon request.

C. Contingency and Remedial Actions and Responsibilities

In the event monitoring reveals that initial success criteria have not been met, the Corps / Local Sponsor shall take measures to achieve those criteria in accordance with the following plan:

1. FILL MATERIAL ELEVATIONS AND AREA

a. Should the initial placement of dredged material not meet the 80% target construction elevation or areal coverage, the Corps / Local Sponsor shall either deposit additional dredged material or redistribute existing material as necessary to achieve the target percentage and areal coverage.

b. At year 5, if less than 75% of the marsh creation area contains emergent vegetation (at least 50% of which have a FAC or wetter designation), then the State of Louisiana may be required, at the discretion of the natural resource agencies, to deposit and plant (according to their specifications) additional dredged material. Should the natural resource agencies decide that such measures are necessary, the location and extent of fill placement and vegetative plantings will be determined in consultation with, and with their approval.

c. From years 6 through 20, if less than 50% of the marsh creation area contains emergent vegetation (at least 50% of which have a FAC or wetter designation), then the State of Louisiana may be required, at the discretion of the natural resource agencies, to deposit additional dredged material and plant these areas (according to their specifications) so that the extent of marsh coverage is at minimum 50% at year 20. Should the natural resource agencies decide that such measures are necessary, the location and extent of fill placement and vegetative plantings will be determined in consultation with, and with their approval.

2. VEGETATIVE PLANTINGS

a. If vegetative plantings survival is less than 50 percent per acre as determined by sampling or by observing high mortality at any location within the planted tract, the Corps / Local Sponsor shall take appropriate actions, as recommended by the natural resource agencies, to address the causes of mortality and shall replace all dead plantings during the following planting season. Replanting and monitoring and reporting, shall occur as needed to achieve and document the required one-year survival rate. If the survival criterion is not met after a second unsuccessful attempt, the Corps / Local Sponsor will convene a meeting to decide if replanting should continue. Should the natural resource agencies determine that achieving the required survival rate would not be likely, the State of Louisiana shall be required to provide replacement mitigation for the increment of value that did not accrue within the unsuccessful tracts within one year

of this decision. In addition, the natural resource agencies will reassess the project specific created marsh to determine if a new management potential should be calculated incorporating the new conditions or whether the use of the specific site should be discontinued.

b. Year 5 monitoring shall verify vegetation composition and survivorship goals. The State of Louisiana shall implement remedial action, as deemed necessary by the natural resource agencies, to ensure attainment of Year 5 survivorship and composition criteria.

D. Long-term Maintenance and Protection

The Corps / Local Sponsor shall be responsible for protecting lands contained within the mitigation project area in perpetuity, unless bank lands are transferred or sold to a state or federal resource agency or non-profit conservation organization. The conservation servitude shall incorporate this mitigation monitoring plan by reference and bind the Sponsor, its heirs, assigns, and future owners to complying with the terms of this copy of the mitigation monitoring plan. A copy of the conservation servitude to be filed in the real estate records of the Mortgage and Conveyance Office for the parish in which the site is located and shall be provided to the Corps for review and approval prior to filing. After filing, a copy of the recorded conservation servitude, clearly showing the book, page and date of filing, will be provided to the LDWF, NMFS, EPA, and USFWS.

Appendix G

FWS COMMENTS " GUIDELINES – WET BLH HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT"

Page 1, Planting Guidelines for Wet BLH Habitat Enhancement – We recommend using standards established by the Natural Resources Conservation Service for seedling selection (e.g., 3/8"-diameter root collar, 12" – 18" stem height plus 8" – 10" root length, and 4 - 8 lateral roots). Those standards (NRCS, Code 612, "Establishment Specifications - Tree/Shrub Establishment") were provided in an attachment to a June 9, 2011, electronic mail message from our office, and can be supplied again, if necessary. The fourth sentence of this paragraph states that planting could be delayed until late spring or early summer. The Service strongly recommends against the planting of bare-root seedlings beyond the standard March 15 deadline. Based on our experience, we would anticipate very high mortality rates for bare-root seedlings that are not dormant when planted.

Page 1, second and third paragraphs - As written a minimum of 3 hard mast and 3 soft mast tree species is required. The Service believes this number is too low to achieve a diverse forest and could result in low survival rates; therefore the Service recommends that this number be increased to 4 hard mast and 5 soft mast species.

Page 2, Table 1A - Table 1A's percent composition for water oak should be no greater than 5% because of poor survival of this species. White ash should be replaced with pumpkin ash.

Page 2, Table 2 - Saltbush, roughleaf dogwood, honey locust, and dwarf palmetto should be removed from this table based on factors such as site suitability, likelihood of natural regeneration, value to wildlife, and commercial availability of seedlings.

Page 3, last paragraph - The Service note's that replanting beyond achievement of the initial success criteria (i.e., 1 year post planting) would be undertaken by the local sponsor. This appears to transfer the Operations Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) to the local sponsor upon attainment of the initial success criteria. The Service recommends that the Corps maintain full responsibility for any mitigation project for a minimum of 4-years post planting. That would allow the 4-year success criteria to be evaluated, prior to turning operation and maintenance responsibilities over to the local sponsor. Based on our experience, it is difficult to reasonably forecast the likely future success of the mitigation project based solely on mitigation activities accomplished during year one. The second monitoring event, performed 4 years after the initial mitigation activities, would provide significantly more insight into the continued development, success, and effectiveness of the implemented features. Because mitigation is a project feature, we believe that waiting for the 4 year monitoring event is analogous to waiting for the completion of a levee lift to start OMRR&R; prior to that, the determination of success or completeness of a project (or project feature) would be lacking.

Page 4, Tables 3 and 4 - Increase the maximum percentage of bald cypress to 70 or 75% and reduce the Drummond red maple percentage to no more than 5%. Bitter pecan should be replaced with water hickory. In Table 4 delete roughleaf dogwood, swamp privet, and swamp rose.

Page 4, Guidelines for the Eradication and Control of Invasive and Nuisance Plant Species - The following information presents a more detailed description of eradication and control methods recommended by the Service. If a site is forested with mature Chinese tallow trees, we recommend that the site be mechanically cleared prior to the application of any chemical. Chemically treating a mature may prove largely unsuccessful due to the relatively uneven canopy structure, which would result in an uneven application, leaving many mid-story and understory stems completely untreated. Mechanical clearing of the site 1 month after chemical treatment, as proposed, would not allow sufficient time for chemicals to be fully transported to the roots (significantly increasing the likelihood of root-sprouting). The proposed timeline for applying ground herbicide following mechanical clearing may also be ineffective because most of the future resprouting would take longer than 1 week to occur.

In order to increase the success of the proposed Chinese tallow-tree eradication, the Service recommends the following sequence of actions (they are listed in chronological order):

1) Mechanically clear the site with a hydro-axe or similar equipment. We support either tree disposal or mulching techniques as previously proposed.

2) Allow a minimum of 2 months (during the growing season) for root resprouting to occur.

3) Use a tractor with boom-sprayer to apply chemicals to the Chinese tallow-tree resprouts. With this method, more cost-effective alternatives to Clearcast® may be used (if a foliar-application chemical is used, then it would not be necessary to use a discriminant/selective chemical such as Clearcast®). Chemical treatment should occur in the late summer or fall, when plant resources are being transported to the roots; this increases the likelihood of a complete "root-kill." The acceptable chemical treatment period is June 1 through October 15, with the optimum period occurring September 1 through October 15. To ensure effectiveness, the treatment must occur before the leaves begin to change color for the autumn season.

4) Allow adequate time for seed germination/sprouting to occur (i.e., a second growing season). Most seeds that did not germinate during the first year of site preparation, should germinate during the second growing season. Chemically treat the site as described in "3" above.

5) Plant bare-root seedlings during the following dormant season (December 15 – March 15). This would allow a minimum of 2 months between the second chemical treatment and the planting of seedlings.

Page 6, third bullet – While allowing water depths of 1 to 2 feet to occur over the swamp such depths could adversely impact seedling survival during the first several years following planting. Therefore, the Service recommends that such water depths be only allowed after almost all seedlings are taller than the expected depth of flooding.

Appendix H

September 13, 2012, Planning Aid Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

September 13, 2012

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference the ongoing effort to prepare the Individual Environmental Report (IER #36) that is being prepared under the approval of the Council on Environmental Quality (CEQ) that will partially fulfill the U.S. Army Corps of Engineers' (Corps) compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321-4347). Individual Environmental Reports are CEQ-approved alternative arrangements for compliance with NEPA that would allow expedited implementation of improved hurricane protection measures. Work proposed in this IER would mitigate impacts resulting from the improved hurricane protection measures and would be conducted under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4). That law authorized the Corps to upgrade two existing hurricane protection projects (i.e., Westbank and Vicinity of New Orleans and Lake Pontchartrain and Vicinity) in the Greater New Orleans area in southeast Louisiana.

This planning-aid letter provides the Service's support for the Tentatively Selected Plan (TSP) for mitigating unavoidable impacts resulting from the Lake Pontchartrain and Vicinity (LPV) hurricane improvement project and addresses the urgency to move forward to ensure mitigation is constructed concurrently with hurricane protection features and is considered equally with the development-related study goals and objectives. These comments and recommendations are provided in accordance with the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), but this letter does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act.

The Corps in coordination with the State and Federal interagency team has identified the TSP for mitigating impacts associated with the LPV hurricane protection project. That plan

includes marsh creation within Bayou Sauvage National Wildlife Refuge (NWR) as mitigation for floodside impacts to brackish marsh that occur on and off NWR lands. Selection of the Bayou Sauvage brackish marsh alternative is supported by several environmental factors. Compared to the geologic site conditions of the Golden Triangle alternative, the Bayou Sauvage alternative experiences lower subsidence and loss rates, resulting in a more sustainable mitigation project location. The Bayou Sauvage alternative is afforded additional protection due to its juxtaposition on the north side of the New Orleans Landbridge. This is supported by and helps implement the multiple lines of defense strategy which acknowledges the benefits of land bridges and their ability to reduce waves and impede storm surge, protecting areas further inland that perform the same function. Further, from a refuge management perspective, the Bayou Sauvage brackish marsh alternative is more easily accessible which supports the use and management of publicly-owned lands. Because the Bayou Sauvage alternative ranks higher in long-term sustainability and property management feasibility, the Service prefers and recommends implementation of this alternative over other brackish marsh alternatives. The Service does not endorse the Golden Triangle alternative as a feature of the TSP.

While costs may be slightly more favorable for implementing the Golden Triangle alternative for both on and off-refuge impacts, the Service's decision to only accept on-refuge mitigation in an area (i.e., Bayou Sauvage alternative) that is more likely to result in successful and sustainable mitigation must be considered. Because the Service supports mitigating on-refuge impacts with the Bayou Sauvage alternative, combining the on and off-refuge impacts as one restoration project at the Bayou Sauvage site would result in a less-costly project compared to implementing two separate brackish marsh mitigation projects (i.e., off refuge at Golden Triangle and on-refuge at Bayou Sauvage).

The Corps continues to request additional analyses and comparisons of alternative features for brackish marsh mitigation from the Service. The Service's habitat assessment of the brackish marsh mitigation features for the LPV hurricane protection project has been completed using the best available scientific information, conducted with interagency team involvement, and when appropriate used best professional judgment. Further, our assessment supports selection of the current TSP. As always, we are available to provide an explanation of our habitat assessment process including the land loss analysis, the interagency team's assumptions, and the limitations and uncertainties involved. Should the Corps decide that the alternative evaluation process needs to be revisited to include additional environmental analyses; we request that a scope-of-work be developed in coordination with our office. That scope should include a comprehensive list of tasks to be completed and a discussion of the purpose and need for those tasks. Transfer of funds prior to the Service initiating such work would also be necessary. Continued delays may necessitate revisiting the current period-of-analysis used in the impact and mitigation assessments to ensure temporal losses are adequately mitigated.

We appreciate the continued cooperation and team effort to complete the project goals in an economically and environmentally sound manner and look forward to continuing our coordination. Should you or your staff have any questions regarding this letter, please contact David Walther (337/291-3122) of this office.

Sincerely,

Jeffrey D. Weller
Field Supervisor
Louisiana Ecological Services Office

cc: SE National Wildlife Refuges, Lacombe, LA
National Marine Fisheries Service, Baton Rouge, LA
EPA, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources, CMD, Baton Rouge, LA
CPRA, Baton Rouge, LA