

FINAL

VOLUME I

COMPREHENSIVE ENVIRONMENTAL DOCUMENT

PHASE I

**GREATER NEW ORLEANS HURRICANE AND
STORM DAMAGE RISK REDUCTION SYSTEM**

MAY 2013



**US Army Corps
of Engineers®
New Orleans District**

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EXECUTIVE SUMMARY

Overview

After the devastation of the 2005 hurricane season, the U.S. embarked on one of the largest civil works projects ever undertaken, at an estimated cost of \$14 billion, with restoration, accelerated construction, improvements, and enhancements of various risk reduction projects within southeastern Louisiana, including the Lake Pontchartrain and Vicinity, Louisiana Project (LPV) and the West Bank and Vicinity, Louisiana Project (WBV), jointly referred to as the **Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS)**. With the completion of the levees, floodwalls, gates, and pumps that together form the HSDRRS, 100-year level of hurricane and storm damage risk reduction will be brought to the areas within LPV and WBV. The agency tasked with the planning, design, and construction of these civil works projects is the **U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN)**. The scope of this document does not discuss the entirety of the post-Hurricane Katrina HSDRRS work, but rather the 217 miles of the HSDRRS located in the Greater New Orleans Metropolitan Area, the area within LPV and WBV, that was analyzed in documents prepared for compliance with the **National Environmental Policy Act of 1969 (NEPA)** through the **Emergency Alternative Arrangements** approved by the **Council on Environmental Quality (CEQ)** and published in the Federal Register on March 13, 2007 (see Federal Register Volume 72, Number 48 at 11337, Tuesday, March 13, 2007).

In order to construct the HSDRRS, the USACE was required by Federal law to follow the requirements of NEPA. Under the typical NEPA process, the start of HSDRRS construction would have waited until the completion of several NEPA reports that analyzed projects in their entirety. By following the normal NEPA requirements, the completion of the reports documenting the USACE's decisions would have taken a significant amount of time (likely 1 to 3 years before any construction could begin). However, this environmental review schedule would not have met the USACE's emergency schedule, and the local needs, for completion of the HSDRRS.

To begin construction of segments of the HSDRRS as soon as possible, the USACE satisfied the NEPA requirements through the use of CEQ-approved Alternative Arrangements. The President’s CEQ, other Federal and state agencies, the public, and non-governmental organizations (NGO) concurred with the USACE’s determination that emergency circumstances warranted the use of alternative NEPA procedures as allowed by the NEPA regulations (40 CFR 1506.11). Notice of the Emergency Alternative Arrangements was published in the Federal Register (Federal Register Volume 72, Number 48, Tuesday, March 13, 2007). Use of the Alternative Arrangements allowed the USACE to complete the NEPA requirements for the **100-year level of hurricane and storm damage risk reduction** (i.e., measures that reduce the risk of hurricane surge and wave-driven flooding in the Greater New Orleans Metropolitan Area in any given year to 1 percent) effort through separate environmental evaluation of numerous smaller construction projects as the engineering design for each segment was developed, rather than waiting to complete the NEPA evaluation once the designs for the entire system were complete. Based on the Emergency Alternative Arrangements, each segment or reach of the HSDRRS in the Greater New Orleans Metropolitan Area was described and analyzed in a document called an **Individual Environmental Report (IER)**. The Emergency Alternative Arrangements also committed the USACE to analyzing the **cumulative impacts** of the HSDRRS in this **Comprehensive Environmental Document (CED)**.

An overview of some of the environmental planning actions taken by the USACE since Hurricanes Katrina and Rita made landfall in August and September 2005, respectively, are listed in table 1.

Table 1. The USACE Environmental Planning Actions

Year	USACE Action
September 2005 through July 2006	The USACE conducted analysis of the impacts on the human and natural environment, which resulted in an after-the-fact Environmental Assessment, the USACE Response to Hurricanes Katrina & Rita in Louisiana to repair or replace 220 miles of levees and floodwalls, and completed repairs within this time frame.
March 2007	The USACE and CEQ entered into the Emergency Alternative Arrangements.
February 2008	The first Decision Record for an HSDRRS IER was signed.
March 2008 to November 15, 2010	Decision Records for 31 IERs and nine IER Supplementals were signed.

Table 1, continued

Year	USACE Action
November 15, 2010	The cutoff date for impacts analyzed in the CED. Future supplements will analyze cumulative impacts occurring after November 15, 2010 (appendix I).
To Be Determined	Supplements to the CED will be completed to address the HSDRRS work finalized after November 15, 2010, and any long-term monitoring actions or future mitigation measures.

The main components of the HSDRRS can be divided into east and west bank components, which are located on both sides of the Mississippi River and are called LPV and WBV, respectively. The HSDRRS is a complex undertaking with a large number of awarded construction contracts. By October 2011, 133 construction contracts were awarded by the USACE for the HSDRRS, and a listing of these contracts can be found in appendix H. The HSDRRS was originally projected to be complete by June 1, 2011; however, due in part to the Mississippi River flooding, which was at or near the historic flood levels of 1927 and 1937, the USACE was unable to fully meet that deadline. Approximately 80 percent of the HSDRRS work was complete by June 2011. For the remaining 20 percent, engineered solutions or interim closure structures are in place until construction is complete, which is anticipated in August 2014. By using these engineered measures, the HSDRRS was able to effectively provide 100-year level of risk reduction by the start of the 2011 hurricane season. After completion of active construction, the USACE will remove these engineering measures.

This CED Executive Summary is divided into six sections: 1) introduction; 2) overview of the HSDRRS; 3) other regional projects; 4) CED organization and results; 5) cumulative impacts summary; and 6) conclusion. The first use of certain words or phrases in bold print can be found in the glossary of terms along with their definitions in appendix B.

1. Introduction

Why did the USACE produce the CED?

Federal agencies must comply with the NEPA, and the NEPA requires that any major Federal action significantly affecting the quality of the human environment be evaluated to identify potential **impacts**

The CED documents the Emergency Alternative Arrangements work completed by the USACE on a system-wide scale...

and adverse environmental effects. The NEPA requires that agencies consider these impacts in their decision-making processes.

The NEPA also resulted in the creation of the CEQ, which drafted regulations governing how Federal agencies are to comply with NEPA. In some emergency circumstances, the CEQ regulations allow a Federal agency to comply with NEPA through alternative procedures with prior approval from the CEQ. After Hurricanes Katrina and Rita, the Emergency Alternative Arrangements under NEPA were implemented so that construction contracts for the HSDRRS could be issued as quickly as possible in order to provide the 100-year level of risk reduction to residents and businesses within the Greater New Orleans Metropolitan Area while still meeting the intent of the NEPA. Under the Emergency Alternative Arrangements, the CED is intended to provide the public with a system-wide look at the work done in the Greater New Orleans, Louisiana area. This document was prepared in accordance with the NEPA and CEQ's regulations (40 Code of Federal Regulations §1500-1508), as modified by the CEQ-approved Emergency Alternative Arrangements.

The Emergency Alternative Arrangements process retains the spirit and intent of the NEPA requirements by providing extensive public input, interagency coordination, consideration of alternatives and assessments of impacts, and identification of any necessary mitigation. The only substantial difference between the typical NEPA process and the Emergency Alternative Arrangements process is the ability of the USACE to segment the HSDRRS into project reaches to more quickly implement construction. These project reaches were evaluated in IER planning documents. These IERs allow for proposed actions to be evaluated and decisions made on how to proceed with portions of the overall system, as well as portions of the sub-basins within LPV and WBV, that have independent utility for reducing risk of flooding in particular areas prior to completing the system-wide analysis. During their preparation, a draft version of each IER had a 30-day review period in which the public and Federal and state agencies were able to provide comments. After the public review period ended, the IER and supporting documentation, along with any public or agency comments, were reviewed by the CEMVN Commander, who, based upon all information available, made an informed decision on whether or not to move forward

with the HSDRRS **Proposed Action** as analyzed in the IER. That decision was documented in an IER **Decision Record** signed by the CEMVN Commander.

Following the signing of the Decision Record, the final design plans and construction contracting process began. The first step in this process was the completion of the HSDRRS design for the individual project reach; work was then approved in a Project Description Document (PDD) that was approved by the Mississippi Valley Division Commander. The USACE and/or the non-Federal sponsor then provided right of entry to any real estate needed for the project, followed by the solicitation of construction contracting bids and award to the contractor with the winning bid. The process ended with the start of the HSDRRS construction. The CED is both a compilation of the data contained in the IERs and an analysis of the cumulative effects of work performed in southeast Louisiana. To read more about the Emergency Alternative Arrangements process and see the Federal Register notice, please refer to appendix A or to the CEMVN environmental planning website at www.nolaenvironmental.gov.

The NEPA Emergency Alternative Arrangements Process



Once completed, the HSDRRS will have the levels of risk reduction necessary to achieve the certification required for participation in the **National Flood Insurance Program (NFIP)**. The NFIP is managed by the Federal Emergency Management Agency (FEMA) and contains three main components: flood insurance, floodplain management, and flood hazard mapping. Congress created the NFIP in 1968 to help property owners financially protect themselves against flooding. Through the NFIP, homeowners, renters, and business owners purchase flood insurance if their community participates in the NFIP. In return, communities participating in the NFIP adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. Since the beginning of the NFIP, it was realized that in order to assess and manage flood risk, a national standard was needed. After extensive study and coordination with Federal and state agencies, the 1 percent annual chance flood (also referred to as the 100-year or

Base Flood) became the standard for the NFIP and is used to administer floodplain management programs. The 100-year flood standard has been used since the inception of the NFIP and is used for floodplain management purposes for all participating communities. An accredited or “certified” levee system is a levee system that has been shown by FEMA to meet the NFIP criteria. In order to become NFIP-accredited, the USACE will undertake the Levee System Evaluation as detailed in Engineering Circular 1110-2-6067, *USACE Process for the National Flood Insurance Program (NFIP) Levee System Evaluation*. The USACE’s use of the phrase “NFIP Levee System Evaluation” rather than the phrase “Levee Certification” emphasizes evaluating the complete HSDRRS’s status with regard to requirements of both 44 CFR 65.10 and the USACE guidelines.

What will the CED contain?

The CED describes the components of the HSDRRS and integrates the results of each IER into a single systematic report. The purpose of the CED is to describe and evaluate the cumulative impacts of the 217 miles of the HSDRRS described by the IERs. The CED also provides a description of the cumulative impacts for projects proposed in southeastern Louisiana, the mitigation process and mitigation measures implemented during the HSDRRS construction, future operations and maintenance requirements, coordination and consultation activities, and compliance with all applicable environmental laws. In addition, the CED also contains updated information for some individual IERs that had incomplete or unavailable data at the time the CEMVN Commander signed a Decision Record. In this document, these are known as data gaps or uncertainties.

What is not included in the CED?

When the NEPA Emergency Alternative Arrangements process and the preparation of the CED were outlined in early 2007, it was not thought that design and associated environmental compliance activities for construction of project features, including mitigation, would continue beyond 2011. However, since the HSDRRS design and construction activities are continuing at the same time this document is being prepared, the cumulative impacts analysis incorporates information from IERs completed by November 15, 2010, to allow for the CED effort to move forward in a timely manner (appendix I). This is the first version of the CED, and in the future,

as the mitigation process, long-term monitoring, and adaptive management commitments are completed, supplements to the CED will be presented to the public. Appendix I contains lists of the IERs both analyzed and not analyzed in the CED.

How do the IERs and the CED satisfy the NEPA Emergency Alternative Arrangements process?

Under the NEPA, a Federal agency must describe the purpose and need for a proposed action and describe its anticipated environmental effects. The NEPA also requires the evaluation of reasonable alternatives to the proposed action, including a “no action” alternative, to allow reviewers an opportunity to evaluate the comparative merits of each. Generally, the purpose and need for the HSDRRS Proposed Actions described in the IERs was to increase public safety and enable the physical and economic recovery of the area to occur through the reduction of storm damage risk to residences, businesses, and other infrastructure from hurricanes (100-year storm events) and other high-water events within the Greater New Orleans Metropolitan Area. In other words, the completed construction of HSDRRS lowers the risk of harm to citizens and damage to infrastructure in the Greater New Orleans Metropolitan Area during a storm event by providing the 100-year level of risk reduction.

To satisfy the Emergency Alternative Arrangements, this document summarizes the HSDRRS impacts and determines the cumulative impacts on the human and “built” environment from those HSDRRS components described by NEPA documents completed by November 15, 2010, and other Federal and non-Federal hurricane and storm damage risk reduction systems and regional projects within southeastern Louisiana. The entire HSDRRS is illustrated in location maps that can be found in appendix D. Future supplements to the CED will update cumulative impacts to include HSDRRS NEPA documents completed after November 15, 2010, and data gaps that could not be addressed at this time.

In general, the IERs were written to allow for proposed actions to be evaluated and decisions made on how to proceed with portions of the overall system, as well as portions of the sub-basins within LPV and WBV, that have independent utility for reducing risk of flooding in particular areas prior to completing the system-wide analysis. In the HSDRRS, and within the context of this document, sub-basins are defined as geographic areas where flood risk is reduced by a

specific segment or reach of the HSDRRS. The HSDRRS project area consists of nine (9) sub-basins and encompasses parts of St. Charles, Jefferson, Orleans, St. Bernard, and Plaquemines parishes, as shown in figure 1. As envisioned and set forth in the Emergency Alternative Arrangements Federal Register Notice, there were to be a total of 21 IERs, 17 IERs for the overall system (LPV and WBV, with their nine sub-basins), together with two IERs for Borrow and two IERs for Mitigation. Additional IERs and IER Addendums and Supplementals were added as appropriate.



Figure 1. The HSDRRS Sub-basins

The actual risk reduction structures addressed by the IERs are **levees**, **floodwalls**, closure structures, and pump station structures. Consequently in this document, these IERs are referred to as **risk reduction IERs**.

Construction of the HSDRRS required significant amounts of material and resources, including **borrow** material (to construct and raise levees), concrete and steel (to construct floodwalls and

floodgates), and other commodities. These materials were transported to construction sites by truck and barge. For the entire HSDRRS, approximately 93 million cubic yards of borrow material was estimated to be required for earthen levee construction. As of November 15, 2010, 11 **borrow IERs** had been completed, which reflected a total of 68 borrow sites that could be used for HSDRRS construction activities. As of July 2011, only 25 borrow sites had been utilized for HSDRRS



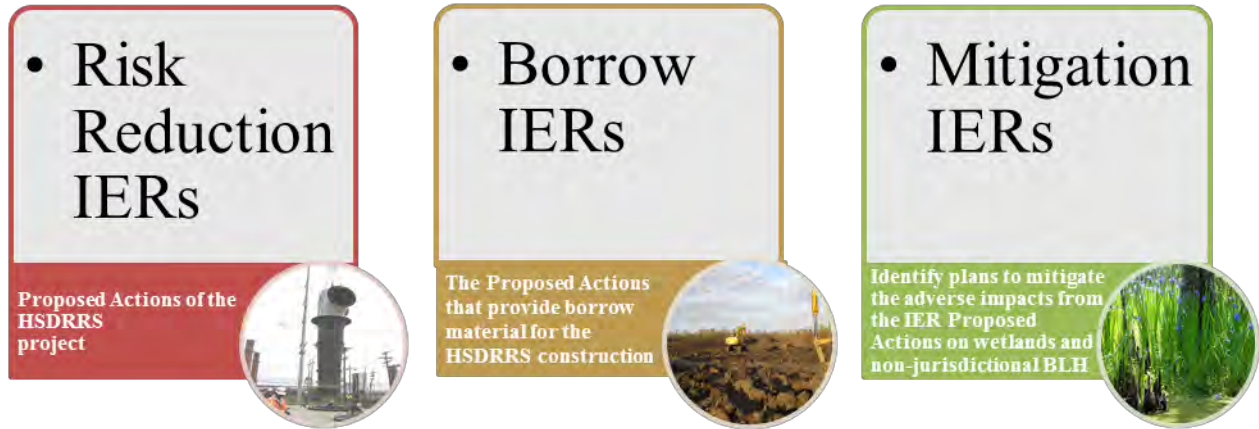
It would take 4.4 million cubic yards of borrow to fill the Mercedes-Benz Superdome, which would need to be filled 21 times to equal the fill needs for the entire HSDRRS.

construction. Borrow sites were located within and outside of the HSDRRS project area and are found within 12 parishes in Louisiana and one county in Mississippi:

- Ascension Parish
- East Baton Rouge Parish
- Iberville Parish
- Jefferson Parish
- Lafourche Parish
- Orleans Parish
- Plaquemines Parish
- St. Bernard Parish
- St. Charles Parish
- St. James Parish
- St. John the Baptist Parish
- St. Tammany Parish
- Hancock County, Mississippi

Although the USACE worked to reduce unavoidable impacts on the human and natural environment to the greatest extent practicable (such as systematically avoiding jurisdictional wetlands during the borrow site designation process), the USACE also understood that significant and *unavoidable* impacts would likely occur with such a large endeavor. Impacts on the human and natural environment can be reduced through **mitigation**, which allows an action to occur but lessens a project's impact on a particular resource or group of resources. Impacts on **wetlands** require compensatory mitigation to reduce the level of impacts and ensure no net loss of wetlands functions. The HSDRRS mitigation measures, including avoidance and minimization of impacts, specific to construction activities were documented in the IERs and are discussed in section 5.0 of the CED. **Mitigation IERs** are being prepared to document data collection efforts, alternatives analysis, mitigation plans, and the proposed sites that could be

used for USACE-constructed mitigation projects, as well as evaluating potential purchase of mitigation bank credits to compensate for impacts on those habitats for which such credits are available. The mitigation IERs are scheduled to be complete in 2013.



Initially, it was anticipated that there would be 21 IERs (see section 2.0). However, once the Emergency Alternative Arrangements process began, it was realized that due to design and construction changes, additional documents would be required to supplement some of these original IERs. These documents are called **IER Supplementals**. Additionally, other IERs were needed in 2010, when the CEMVN proposed additional HSDRRS risk reduction work under IERs #27 and #33, and nine other borrow IERs were completed (see appendix I).

The first Decision Record was signed in February 2008 for IER #19, and as of November 15, 2010, the CEMVN had signed 40 IER Decision Records (appendix I). Supplements to the CED will be prepared in the future to include any Alternative Arrangements environmental documents prepared after November 15, 2010. Supplements to the CED will include the results of the mitigation IERs (IER #36 and #37) and environmental monitoring associated with adaptive management commitments.

Exactly what is the HSDRRS?

The HSDRRS in the Greater New Orleans Metropolitan area described by Alternative Arrangements' IERs and the CED comprises 217 miles of integrated east bank (LPV) and west bank (WBV) components located on both sides of the Mississippi River, including construction of levees, floodwalls, 56 gates (including sector gates), one barrier, nine drainage structures,

repair of numerous pump stations, and stormproofing of 30 pump stations. The HSDRRS is designed using the post-Hurricane Katrina design criteria and is designed to reduce the risk from a storm surge that has a 1 percent chance of being equaled or exceeded in any given year (100-year risk reduction), which provides the levels of risk reduction necessary for the certification thereof required for participation in the NFIP.

The LPV project components are shown in figure 2 and consist of the following (with all structure heights in North American Vertical Datum [NAVD] 88):

- St. Charles - Levee and floodwall maximum height 18.5 feet (ft)
- Jefferson East Bank - Levee and floodwall maximum height 17 ft
- Orleans East Bank - Levee and floodwall maximum height 21 ft
- New Orleans East - Levee and floodwall maximum height 30 ft
- Chalmette Loop - Levee and floodwall maximum height 31 ft



Figure 2. The HSDRRS LPV Sub-basins

The LPV HSDRRS project components include portions of St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard parishes. Some specific LPV HSDRRS segments provide an enlarged levee along portions of the Orleans Lakefront within the Orleans East Bank and New Orleans East sub-basins, and levees, floodwalls, **floodgates**, and **sector gates** from the Orleans Lakefront to the Gulf Intracoastal Waterway (GIWW). Throughout the LPV sub-basins, the system raised levees and replaced floodwalls, as well as constructed numerous floodgates at road and railroad crossings. Various large control structure complexes, such as the Seabrook Floodgate Complex at Lake Pontchartrain and the nearly 2-mile-long **Borgne barrier**, which crosses the deauthorized Mississippi River Gulf Outlet (MRGO), GIWW, and Bayou Bienvenue, were also constructed.



Artist's rendering of the Seabrook Floodgate Complex

The WBV HSDRRS project components include portions of Orleans, Jefferson, and Plaquemines parishes. The WBV projects provide approximately 91 miles of structural measures with the construction of levees, floodwalls, floodgates, and a sector gate, while also achieving the levels of risk reduction necessary for the certification required for participation in the NFIP. The following are the sub-basins for the WBV projects and structure heights, which are provided in NAVD 88, and shown in figure 3.



Figure 3. The HSDRRS WBV Sub-basins

- Belle Chasse - Levee and floodwall maximum height 16.5 ft
- Gretna-Algiers - Levee and floodwall maximum height 10.5 ft
- Harvey-Westwego - Levee and floodwall maximum height 16 ft
- Lake Cataouatche - Levee and floodwall maximum height 15.5 ft

Who provided the authority for the HSDRRS work?

The Congress enacted legislation through a series of **supplemental appropriation acts** following Hurricanes Katrina and Rita to restore, replace, reinforce, armor, and accelerate completion of the hurricane protection system damaged by the storms; and provided the additional authority to the USACE to raise levee heights and otherwise enhance the LPV and WBV projects to provide the levels of risk reduction necessary to achieve the certification required for participation in the NFIP (HSDRRS). The USACE generally refers to the different HSDRRS post-Katrina authorizations and funding appropriation acts by the term Supplemental (such as the 3rd and 4th Supplemental, etc.). Since 2005, there have been nine acts by Congress

Post-Hurricane Katrina Legislative Acts for the HSDRRS

Emergency Supplemental Appropriations Act to Meet Immediate Needs Arising from the Consequences of Hurricane Katrina, 2005 (Public Law [P L] 109-61).

Second Emergency Supplemental Appropriations Act to Meet Immediate Needs Arising from the Consequences of Hurricane Katrina, 2005 (P L 109-62).

Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico.

Pandemic Influenza Act of 2006 (P L 109-148), Chapter 3, Construction, and Flood Control and Coastal Emergencies (3rd Supplemental).

Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery of 2006 (P L 109-234), Title II, Chapter 3, Construction, and Flood Control and Coastal Emergencies (4th Supplemental)

U.S. Troop Readiness, Veteran's Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007(P L 110-28), Title IV, Chapter 3, Flood Control and Coastal Emergencies, Section 4302 (5th Supplemental)

Water Resources Development Act of 2007 (P L 110-114)

Supplemental Appropriations Act of 2009 (P L 110-252), Title III, Chapter 3, Construction (6th Supplemental)

Consolidated Security, Disaster Assistance, and Continuing Appropriations Act of 2009 (P L 110-329) or (7th Supplemental)

Consolidated Appropriations Act, 2012 (P L 112-74)

to provide storm risk reduction to the Greater New Orleans Metropolitan Area (see the Post-Hurricane Katrina Legislative Acts for the HSDRRS text box).

How did the USACE determine what heights or elevations were needed for the HSDRRS?

In order to know what heights (or elevations) were needed to rebuild the levees and floodwalls for the HSDRRS, the USACE used a new, advanced modeling process in which 152 historical and hypothetical hurricanes and their tracks into Louisiana were modeled with large supercomputers. This modeling was called the **Joint Probability Method with Optimal Sampling (JPM-OS) Process**, and this process determined the 1 percent surge elevations, wave heights, and wave characteristics for existing conditions within southeast Louisiana. The USACE then applied these data to estimate wave run-up (additional water elevation due to the impact of waves near the shore interacting with individual structures) and overtopping and conducted further analysis to determine the conditions that might occur 50 years in the future (the year 2057) due to subsidence (the sinking of the land) and sea-level rise.

The results from these modeling efforts provided the basis for the design guidelines for the HSDRRS. The thousands of calculations performed in the JPM-OS process underlie why risk reduction reach segment heights vary throughout the HSDRRS. For

example, even though one business or residence may have an earthen levee or floodwall located nearby that is constructed to a height of 15 ft, that height provides the *same reduction of risk* as an 18.5 ft high earthen levee or floodwall at a different location within the HSDRRS. To account for potential elevation changes over the next 50 years from sea-level rise and subsidence, additional **structural superiority** design elements were also included in some features of the HSDRRS.

What are impacts and what are cumulative impacts?

Impacts are considered to be any adverse or beneficial consequences on the human and natural environment caused by the implementation of an action and would include any irreversible and irretrievable commitments of resources should the action be implemented. Through the HSDRRS design process, USACE strived to limit potential environmental degradation, risks to health or safety, or other undesirable and unintended consequences from its actions. Nevertheless, some impacts were unavoidable. Impacts are considered to be:

- Direct – when caused by an action and occurring at the same time and place.
- Indirect – when caused by an action and occurring later in time or further removed in distance, but still reasonably foreseeable. Indirect impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
- Cumulative – when caused by the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

Impacts or effects include those that are ecological (such as the effects on wildlife and natural habitats), aesthetic, historic and cultural, economic, and social.

In addition, cumulative impacts may result in additive or interactive effects. To assess cumulative impacts, one must consider not only the impacts from a single project (such as a single project component of the HSDRRS), but also other Federal and non-Federal projects' effects on the human and natural environment. Non-Federal projects could include new business, port expansion, road building, or new residential development, in addition to other

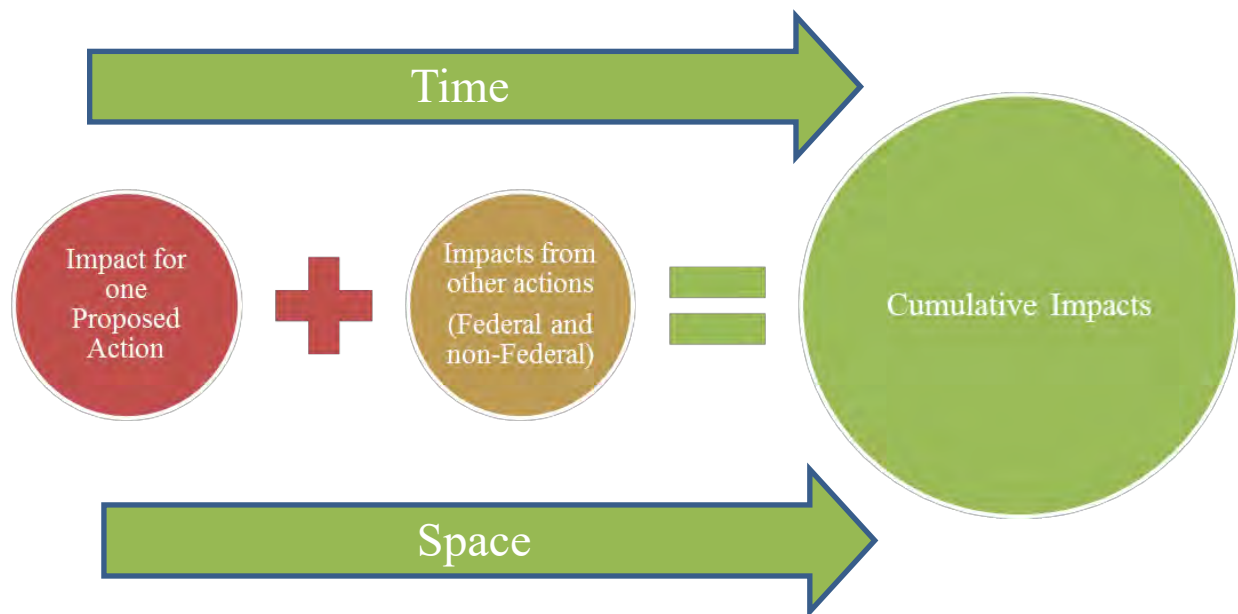
regional proposed work. Additionally, cumulative impacts or effects can be characterized as being both geographical and over time (spatial and temporal). Some examples of reasonably foreseeable cumulative impacts could be such things as:

Cumulative Time Effects (Temporal Effect)

- Loss of wetlands, which is characterized by a frequent and repetitive effect on the natural environment from subsidence, sea-level rise, or man-made actions such as development.
- Degradation of air quality caused by the construction and operation of numerous different industries over a 10-year period.

Cumulative Geographic Effects (Spatial Effect)

- Changes in a historic district due to a change in building codes that may cause district fragmentation.
- Inland waterway salinity changes where the effect may be some distance removed from the sea and in another regional area.



Through the use of the NEPA Emergency Alternative Arrangements process, which allowed analysis of discrete components of the HSDRRS in the IERs rather than evaluating the entire system within one NEPA document, the USACE was able to proceed more quickly than the normal NEPA process would allow. However, the Alternative Arrangements provide for an

analysis of the overall HSDRRS effort in relation to all the other work being performed in the project region through this CED.

2. Overview of the HSDRRS

One of the greatest public concerns throughout southeast Louisiana was how the USACE would reduce the risk of hurricane, storm, and flood damage for businesses and residences and provide public safety during major storm events. In order to accomplish this, the USACE needed to employ an integrated, comprehensive, and system-based approach to hurricane and storm damage risk reduction. The HSDRRS was born of this need.

100-year level of risk reduction refers to reducing risk from a storm surge that has a 1 percent chance of being equaled or exceeded in any given year.

The HSDRRS is comprised of 100-year level of risk reduction features in nine sub-basins within the Greater New Orleans Metropolitan Area. All of the sub-basins, except for the New Orleans East sub-basin, are located along the Mississippi River. Flood risk reduction from the Mississippi River flow is provided by the **Mississippi River and Tributaries (MRT) Project**. While the authorized purpose



Duncan Pump Station

of the MRT is not as a hurricane and storm damage risk reduction project, the MRT does provide a Mississippi River boundary for the HSDRRS (LPV and WBV). Although the MRT authorized design elevation does not meet the 100-year level of risk reduction in all areas, where the MRT may be subject to hurricane storm surge and does not meet the 100-year design elevation, HSDRRS features are being added on top of, or over, the MRT levee to meet the 100-year risk reduction requirements (IER #33 and IER Supplemental #33). Together, these HSDRRS, MRT,

and MRT/HSDRRS co-located components form a closed loop around the entire area without breaks or openings, providing storm risk reduction to residents and businesses within the Greater New Orleans Metropolitan Area that meets NFIP certification requirements.

The LPV project was originally authorized by the Flood Control Act of 1965 after Hurricane Betsy caused flooding and levee failure in New Orleans. The NEPA Environmental Impact Statement (EIS) documents began in the 1970s for the LPV. The WBV project was authorized by the Water Resource Development Act of 1986, and work was still being performed in 2005 when Hurricane Katrina made landfall.

The period of evaluation for HSDRRS is 50 years. The hard structures (such as floodwalls and floodgates) were designed and constructed to meet the elevations required to accommodate projected sea-level rise and subsidence rates in southeastern Louisiana until 2057. Earthen levees were designed and built to immediately provide the 100-year level of risk reduction, which is referred to as HSDRRS 2011 construction requirements. However, earthen levees settle over time due to soil conditions, and compaction, settlement, subsidence, and sea-level rise contribute to increasing heights necessary to provide 100-year level of risk reduction over time. Additional suitable material or “lifts” for earthen levees would be required in the future to continue to provide 100-year level of risk reduction. Future levee lifts are anticipated to account for under-consolidated soils common to this area, subsidence, and sea-level rise. Although future HSDRRS work would be necessary to meet HSDRRS 2057 100-year level of risk reduction elevations, such work has not been authorized in the current supplemental authorization and appropriation acts. The additional borrow material required for future HSDRRS levee lifts through 2057 is currently projected to be approximately 11 million cubic yards.

Lake Pontchartrain and Vicinity Project of the HSDRRS



The east bank (LPV) project components include construction of 126 miles of structural risk reduction features located in St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard parishes in southeast Louisiana, generally in the

vicinity of the City of New Orleans, and between the Mississippi River, Lake Pontchartrain, and Lake Borgne. The overall project is designed to provide 100-year risk reduction to residents between Lake Pontchartrain and the Mississippi River levee from storm-driven surges primarily from Lake Pontchartrain and Lake Borgne. All the LPV project HSDRRS features, together with the MRT levees, ultimately allow residents to participate in the NFIP.

At the western terminus of the levee system in St. Charles Parish (Bonnet Carré Spillway East Guide Levee), there is an earthen levee that proceeds east along the north side of Airline Highway (U.S. Highway 61) to the Jefferson-St. Charles Parish boundary and includes control structures and a pump station. In Jefferson Parish, there is a concrete floodwall along the Jefferson-St. Charles Parish line and an earthen levee along the Jefferson Parish Lakefront, which includes floodgates and pump stations. In Orleans Parish, the earthen levee is located along the shoreline of Lake Pontchartrain with parallel protection (levees, floodwalls, and floodgates) along three outfall canals (17th Street, Orleans Avenue, and London Avenue). Three interim canal



Buras floodwall construction

closures and pump stations are located, and three permanent canal closures and pump stations will be located, at the mouths of the 17th Street, Orleans Avenue, and London Avenue outfall canals. A series of earthen levees/floodwalls comprise the HSDRSS from the New Orleans Lakefront to the GIWW, and includes the Seabrook Floodgate Complex and portions of the Borgne Barrier. In St. Bernard Parish, a portion of the IHNC/GIWW surge barrier ties into levee segments that run parallel to the now de-authorized portion of the MRGO and includes floodwalls and a sector gate at Bayou Dupre; levees and floodwalls continue around the Chalmette area back to the tie-in with the Mississippi River Levee in Plaquemines Parish. Fronting protection and backflow prevention was also used at numerous non-Federal pump stations in Orleans and Jefferson Parishes as part of the LPV portion of the HSDRRS.

A total of 14 IERs (and associated supplements) describe the east bank (LPV) HSDRRS components and are shown in Location Maps 1 through 16, which can be found in appendix D. These 14 LPV IERs are as follows:

Risk Reduction LPV IERs

- IER #1: *Lake Pontchartrain and Vicinity, LaBranche Wetlands Levee, St. Charles Parish, Louisiana*
 - IER Supplemental #1
- IER #2: *Lake Pontchartrain and Vicinity, West Return Flood Wall, Jefferson and Orleans Parishes, Louisiana*
 - IER Supplemental #2
- IER #3: *Lake Pontchartrain and Vicinity, Lakefront Levee, Jefferson Parish, Louisiana*
 - IER Supplemental #3.a
- IER #4: *Lake Pontchartrain and Vicinity, Orleans East Bank, New Orleans Lakefront Levee, West of Inner Harbor Navigational Canal to East Bank of 17th St. Canal, Orleans Parish, Louisiana*
- IER #5: *Permanent Protection System for the Outfall Canals Project on 17th Street, Orleans Avenue, and London Avenue Canals, Jefferson and Orleans Parishes, Louisiana*
- IER #6: *Lake Pontchartrain and Vicinity, New Orleans East Citrus Lakefront Levee, Orleans Parish, Louisiana*
 - IER Supplemental #6
- IER #7: *Lake Pontchartrain and Vicinity, New Orleans East Lakefront to Michoud Canal, Orleans Parish, Louisiana*
 - IER Supplemental #7
- IER #8: *Lake Pontchartrain and Vicinity, Bayou Dupre Control Structure, St. Bernard Parish, Louisiana*
- IER #9: *Lake Pontchartrain and Vicinity, Caernarvon Floodwall, St. Bernard Parish, Louisiana*
- IER #10: *Lake Pontchartrain and Vicinity, Chalmette Loop Levee, St. Bernard Parish, Louisiana*
- IER #11: *Improved Protection of the Inner Harbor Navigation Canal, Orleans and St. Bernard Parishes, Louisiana*
 - IER Supplemental #11 Tier 2 Borgne
 - IER Supplemental #11.a Tier 2 Borgne
 - IER # Supplemental #11 Tier 2 Pontchartrain

- IER #27: *Outfall Canal Remediation on the 17th Street, Orleans Avenue and London Avenue Canals, Jefferson and Orleans Parishes, Louisiana*

West Bank and Vicinity Project of the HSDRRS



The WBV project components provide 91 miles of hurricane risk reduction structural features from Lake Cataouatche to Oakville in the vicinity of New Orleans. Projects consist of a continuous system of earthen levees, floodwalls, floodgates, and a sector gate/pump station complex.

The overall mission of the WBV components is to reduce the risk of storm surge from Lake Cataouatche, Lake Salvador, and other waterways leading to the Gulf of Mexico. In general, the existing project features were replaced, raised, or enhanced to achieve the 100-year storm risk reduction. More specifically, the Oakville Levee (eastern tie-in) connected the WBV to the MRT levees, which provide an HSDRRS “closure” on the west bank. Levees at Hero Canal, Algiers Canal, Westwego to Harvey, and Lake Cataouatche were brought to 100-year risk reduction design standards. In addition, floodwalls throughout the west bank (such as at Bayou Segnette and Company Canal) were replaced and a closure complex called the Gulf Intracoastal Waterway West Closure Complex was constructed, which consists of a streamlined surge barrier, floodwall, levee alignment, sluice gates, sector gate, and pump station. Fronting protection and backflow prevention was also used at numerous non-Federal pump stations in Orleans, Jefferson, and Plaquemines parishes as part of the WBV portion of the HSDRRS.

A total of six IERs (and associated supplements) describe the HSDRRS component on the west bank and are shown on Location Maps 17 through 23, found in appendix D. These six WBV IERs are as follows:

Risk Reduction WBV IERs

- IER #12: *Gulf Intracoastal Waterway (GIWW), Harvey and Algiers Levees and Floodwalls, Jefferson, Orleans, and Plaquemines Parishes, Louisiana*

- IER Supplemental #12
- IER #13: *West Bank and Vicinity Hero Canal Levee and Eastern Tie-In, Plaquemines Parish, Louisiana*
- IER #14: *West Bank and Vicinity Westwego to Harvey Levee, Jefferson Parish, Louisiana*
 - IER Supplemental #14.a
- IER #15: *West Bank Vicinity Lake Cataouatche Levee, Jefferson Parish, Louisiana*
- IER #16: *West Bank Vicinity Western Tie-In Levee, Jefferson and St. Charles Parishes, Louisiana*
 - IER Supplemental #16.a
- IER #17: *West Bank Vicinity Company Canal Floodwall, Jefferson Parish, Louisiana*

Borrow IERs

The USACE pursued three methods for suitable borrow material: government-furnished borrow, contractor-furnished borrow, and supply contract borrow. With the government-furnished method, the USACE or its non-Federal sponsor would acquire the appropriate real estate interest in land to excavate borrow material. With the contractor-furnished method, the USACE would require the construction contractor to furnish its own borrow material. That is, the contractor would make its own arrangements with the owner of land to obtain geotechnically suitable material from a site that had been environmentally cleared through the IER process. With the supply contract method, the USACE would advertise



Earthen levee with access road near St. Jude

and award a separate supply contract for the delivery of suitable borrow material to designated areas. For each project feature, the USACE selected the method that was determined to be in the best interest of the Government. Borrow sites were found throughout southeast Louisiana and Hancock County, Mississippi. Figure 4 indicates the geographical range of the potential borrow sites that the USACE could use for the HSDRRS construction. The need for borrow material for the HSDRRS was of such large quantities that the USACE environmentally cleared many more

borrow sites than will ever be needed to complete HSDRRS construction. As of November 15, 2010, 11 IERs were prepared to complete environmental compliance requirements and designate borrow sites that could be used for the construction of the HSDRRS. Any additional borrow IERs prepared to designate additional borrow sites as suitable for use in HSDRRS construction after November 2010 will be assessed in future supplements to the CED.

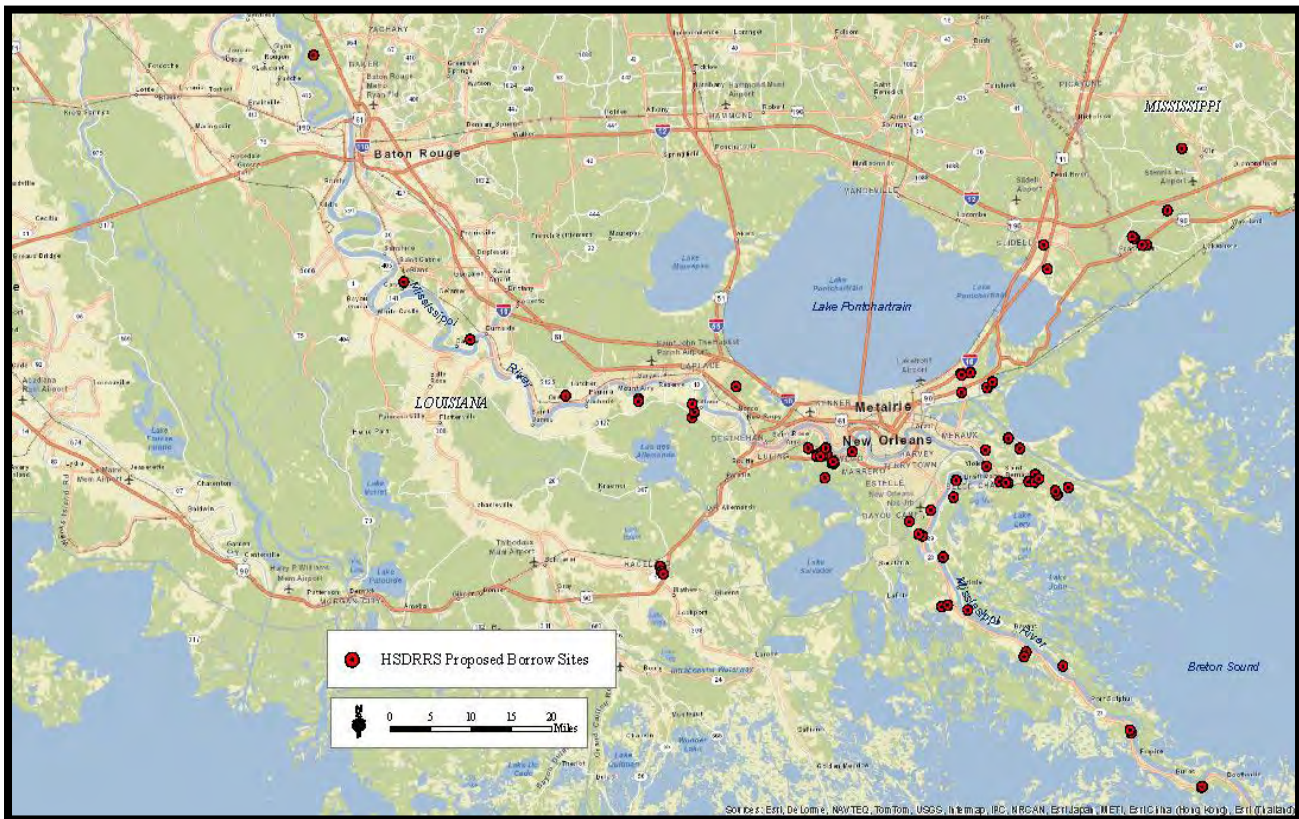


Figure 4. Geographical Range of the Potential HSDRRS Borrow Sites Analyzed in the CED

The 11 borrow IERs are:

- IER #18: *Government-Furnished Borrow Material, Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard Parishes, Louisiana (12 proposed sites)*
- IER #19: *Pre-Approved Contractor-Furnished Borrow Material, Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parishes, Louisiana, and Hancock County, Mississippi (nine proposed sites)*
- IER #22: *Government-Furnished Borrow material #2, Jefferson and Plaquemines Parishes (five proposed sites)*

- IER #23: *Pre-Approved Contractor-Furnished Borrow Material #2, St. Bernard, St. Charles, Plaquemines Parishes, Louisiana, and Hancock County, Mississippi* (five proposed sites)
- IER #25: *Government-Furnished Borrow Material #3, Orleans, Jefferson, and Plaquemines Parishes* (four proposed sites)
- IER #26: *Pre-Approved Contractor-Furnished Borrow Material #3, Jefferson, Plaquemines, and St. John the Baptist Parishes, Louisiana, and Hancock County, Mississippi* (five proposed sites)
- IER #28: *Government-Furnished Borrow #4, Jefferson, Plaquemines, and St. Bernard Parishes* (three proposed sites)
- IER #29: *Pre-Approved Contractor-Furnished Borrow # 4, Orleans, St. John the Baptist, and St. Tammany Parishes, Louisiana* (three proposed sites)
- IER #30: *Contractor-Furnished Borrow Material #5, St. James and St. John the Baptist Parishes, Louisiana, and Hancock County, Mississippi* (three proposed sites)
- IER #31: *Contractor-Furnished Borrow Material #7, East Baton Rouge, Jefferson, Lafourche, Plaquemines, St. Bernard, and St. Tammany Parishes, Louisiana, and Hancock County, Mississippi* (10 proposed sites)
- IER #32: *Pre-Approved Contractor-Furnished Borrow Material #5, Plaquemines, Ascension, and St. Charles Parishes* (seven proposed sites)

3. Other Regional Projects

A vast amount of rebuilding work is being performed regionally following the devastation of the 2005 hurricane season. In order to quantify these regional efforts or actions, the CEMVN canvassed a wide array of resources to try to bring the impacts of as much of this rebuilding effort as practicable under one overarching evaluation of impacts due to regional actions. In this document, the ongoing and future actions were broadly addressed through the following five subheadings for the regional projects:



Wetland restoration technique: beneficial use of dredged material

- Storm Damage Reconstruction
- Redevelopment
- Coastal and Wetlands Restoration
- Flood Risk Reduction Projects
- Transportation

Other Flood Risk Reduction Projects

Other projects authorized by Congress in supplemental appropriation acts complement (e.g., the Southeast Louisiana project) or connect to the HSDRRS (e.g., the New Orleans to Venice project). Descriptions of these flood risk reduction projects are discussed in detail in section 3.0 of the CED.

New Orleans to Venice, Louisiana Hurricane Protection Project

The New Orleans to Venice (NOV) project straddles the Mississippi River in Plaquemines Parish and was originally authorized by the Flood Control Act of 1962 (P L 87-874). In the aftermath of the 2005 hurricane season, Congress authorized restoration and accelerated completion of the NOV project and authorized the incorporation of certain non-Federal levees into NOV. Funding of \$769 million was provided through the 3rd, 4th, 6th, and 7th supplementals passed by Congress. On the east bank, the project extends 16 miles along the back levee from the towns of Phoenix to Bohemia, Louisiana. On the west bank, the project extends 34 miles and consists of work on the back levee, as well as on the Mississippi River levee, from the St. Jude Church to the town of Venice, Louisiana. The entire levee project consists of approximately 90 miles of levee upgrades.

The NOV project would increase the elevation of Federal flood risk reduction structures to meet the authorized design grade and stabilize those sections of levees where subsoil deficiencies or internal levee deficiencies undermine their strength. In most levee sections, this would involve elevating the levee crest with earthen fill and expanding the levee base footprint to provide the necessary design strength to support the added height of the levee. Concrete T-walls would be repaired or replaced on top of some levees, where design and cost factors dictate. Existing pump station walls and floodgates would also be restored and armored to meet the authorized design criteria.

Prior to Hurricane Katrina in 2005, the NOV project was approximately 85 percent complete. A Supplemental EIS for the NOV project entitled *Supplemental Environmental Impact Statement New Orleans to Venice Federal Hurricane Protection Levee Plaquemines Parish, Louisiana* was provided for a public review period that ended on July 25, 2011. The project's Record of Decision (ROD) was signed on October 31, 2011. This project is scheduled for completion in 2015.



New Orleans to Venice project levee reaches

Plaquemines Parish Non-Federal Levee Project

This project includes replacing or modifying 32 miles of non-Federal levees on the west bank of the Mississippi River to incorporate into NOV. An EIS entitled *New Orleans to Venice, Louisiana, Hurricane Risk Reduction Project: Incorporation of Non-Federal Levees from Oakville to St. Jude Plaquemines Parish, Louisiana* was provided for a public review that ended on July 11, 2011. The project's ROD was signed on October 31, 2011.

Grand Isle and Vicinity Hurricane Protection Project

The Grand Isle Beach Erosion and Hurricane Protection Project was authorized by resolutions of the House of Representatives and the Senate dated September 23, 1976 and October 1, 1976, respectively, under Section 201 of the Flood Control Act of 1965 dated October 27, 1965, P L 89-298, House Document Number 94-639. In the 1970s, the State of Louisiana constructed a 2,600 ft long stone jetty on western Grand Isle and a sand-



Initial placement of geo-textile tubes

filled dune and berm along the shore; these features eventually were incorporated into the Federal project. A jetty was constructed at the east end of the island by the State of Louisiana in 1964; however, it was never incorporated into the Federal project. By 1985, the Grand Isle Beach Erosion and Hurricane Protection Project was essentially complete.

Hurricanes Danny, Elena, and Juan struck Grand Isle in 1985, and from 1985 to 1989 the USACE went through several iterations of designs to repair the project. A cusped bar was dredged and used to restore the beach and dune at the state park. A breakwater consisting of two small areas of biodegradable sand-filled bags was built on the shore of Grand Isle. The west-end jetty was extended 500 feet, and the east-end jetty (which is not part of the authorized project) was extended 200 feet. In 1989, the Town of Grand Isle built a stabilization complex consisting of two groins, a seawall, and four segmented offshore breakwaters. In 1991, additional nourishment of the beach and dune repair was completed. Following Hurricane Andrew in 1992, an evaluation of breakwaters was implemented in order to reduce the erosion rate back to the

levels predicted during the original Hurricane Protection Project design. Between December 1994 and May 1995, 23 breakwater segments were constructed.

Prior to the fall of 2008, there was an ongoing construction project to repair damages to the Federal dune project caused by Hurricane Katrina. The USACE conducted emergency repairs along an approximately 8,000 linear ft reach on the western end of the island on the Gulf-side levee, known as the Grand Isle and Vicinity project. That work was conducted between September 2008 and early 2009 after Hurricane Gustav. In 2009, the USACE completed additional rehabilitation of the Grand Isle and Vicinity project with rehabilitation of approximately 5.7 miles of the sand-covered berm along the entire Gulf-side beach by constructing geo-textile tubes and then covering those with sand. In 2010, the USACE performed additional repairs of a feature of the Grand Isle and Vicinity project, the west-end jetty. The 2008, 2009, and 2010 work was performed in response to damage caused by Hurricane Gustav and Hurricane Ike.

Morganza to the Gulf Risk Reduction Project

In March 2002, a feasibility report and Programmatic EIS entitled *Mississippi River & Tributaries - Morganza, Louisiana to the Gulf of Mexico Hurricane Protection* was prepared by the USACE. This document was revised and supplemented from 2002 to 2004.

The recommended plan proposed a series of flood risk reduction measures and included the following:

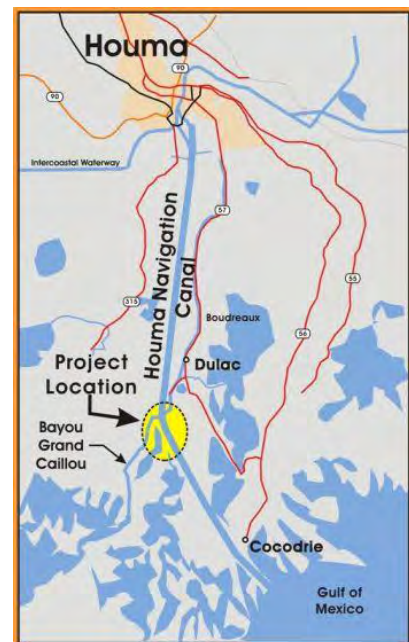
- the construction of approximately 72 miles of levee south of Houma.
- the construction of ten 56 ft wide sector gate structures, three 125 ft wide sector gate structures, and 13 tidal exchange structures.
- the construction of a lock structure and floodgate complex for the Houma Navigation Canal.

The Morganza to the Gulf project was authorized to provide the 100-year level of hurricane and storm damage risk reduction based on feasibility reports and 2002 and 2003 reports of the Chief of Engineers. However, these were completed prior to development and implementation of post-

Hurricane Katrina design criteria. In the interest of public safety, and to be consistent with design policy established for the Greater New Orleans Metropolitan Area, the USACE is incorporating lessons learned from Hurricanes Katrina and Rita into the designs for the Morganza to the Gulf project.

Currently, it is estimated that the cost to incorporate post-Hurricane Katrina design criteria into this project will exceed the authorized project cost by more than 20 percent, thereby exceeding the 1986 Water Resources Development Act (WRDA) Section 902 limit and triggering the need for reauthorization by Congress. A Post-Authorization Change Report is currently being developed to seek reauthorization.

A revised Programmatic EIS will be prepared for concurrent submittal with the Post-Authorization Change Report. This document will evaluate changes in existing conditions and evaluate all direct and indirect environmental impacts of increased levee footprints resulting from the post-Hurricane Katrina design criteria. The revised Programmatic EIS will include sufficient detail for any constructible features (i.e., Houma Navigation Canal Lock complex) so that no additional environmental clearances will be required for those features upon signing of the ROD. The Post-Authorization Change Report and revised Programmatic EIS are scheduled for completion in 2013.



Location of Houma Navigation Canal lock and floodgate complex

Mississippi River Gulf Outlet Deep-draft De-authorization

The MRGO was constructed to provide a 66-mile, 40 ft deep draft navigation access from the Gulf of Mexico to the New Orleans port area. The New Orleans port is located along the upper reaches of the MRGO and the IHNC, close to the junction of the GIWW and the Mississippi River. The surface dimensions of the channel have increased beyond those of the original construction, and in some areas, the width of the channel appreciably widened as a result of

erosion. The authorized channel width for the project was 500 ft, but the channel is more than 2,000 ft wide at some locations.



View of MRGO in southeast Louisiana

The U.S. Congress directed the Secretary of the Army, acting through the Chief of Engineers, to develop a plan for de-authorization of deep-draft navigation for the MRGO from the Gulf of Mexico to GIWW. In a December 2006 Interim Report, eight alternatives were developed that would allow continued shallow-draft navigation, including four that completely closed the MRGO from the GIWW to the Gulf of Mexico, and one that would cease all navigation maintenance activities on the MRGO from the GIWW to the Gulf of Mexico.

On June 5, 2008, the Assistant Secretary of the Army for Civil Works forwarded the *Integrated Final Report to Congress and Legislative Environmental Impact Statement for the Mississippi River – Gulf Outlet Deep-Draft De-authorization Study* to Congress. This action officially de-authorized the MRGO from the GIWW to the Gulf of Mexico in accordance with the WRDA of 2007. The report can be found at <http://mrgo.usace.army.mil/>. The portion of the MRGO channel from mile 60 at the southern bank of the GIWW to the Gulf of Mexico was de-authorized for all navigation use. However, approximately 6 miles of the MRGO channel (from mile 66 to mile 60), the Michoud Canal Project, and the IHNC Lock Replacement Project remain authorized. As part of the plan, a total rock closure structure was built in July 2009 at the south ridge of Bayou La Loutre in St. Bernard Parish, Louisiana.

The USACE developed the MRGO Ecosystem Restoration Plan as a supplement to the MRGO Deep-Draft De-Authorization Report. Currently, the USACE has completed a feasibility study that results in a comprehensive ecosystem restoration plan to restore Lake Borgne and areas affected by the MRGO channel. This restoration plan was developed in accordance with Section 7013 of the WRDA of 2007. The purpose of the study is to address systematic ecosystem restoration with consideration of measures to reduce or prevent damages from storm surge. Features outlined in the plan include creating marsh using dredged material, planting cypress trees and other wetland vegetation, protecting shorelines with breakwaters, creating oyster reefs, and diverting freshwater from the Mississippi River near the community of Violet, Louisiana, to reduce salinity and enhance wetlands and fishery productivity. The plan also includes proposed public access recreation features in Shell Beach, Meraux, and the Lower Ninth Ward. The coastal restoration plan is a follow-up report to the 2008 de-authorization plan that the USACE implemented to close the MRGO ship channel with a rock barrier at Bayou La Loutre.

Inner Harbor Navigation Canal (IHNC) Lock Replacement Project

The current IHNC lock, built in 1921, is 640 ft long, 75 ft wide, and 31.5 ft deep and connects the Mississippi River with the IHNC, GIWW, and MRGO. The current lock is too small to accommodate modern-day deep draft vessels. The replacement project was authorized by a March 29, 1956 Act of Congress (P L 84-455), and was amended by Section 186



The IHNC looking south-southwest

of the WRDA of 1976 (P L 94-587). Eight potential sites for a new lock were evaluated through planning efforts and public involvement beginning as early as 1960. WRDA of 1986 (P L 99-662) modified the project to locate the new lock at either the existing lock site or at the Violet site, and modified the project's cost-sharing agreement. The USACE evaluated various alternatives for a replacement lock in a 1997 *Final Environmental Impact Statement for the Mississippi River – Gulf Outlet New Lock and Connecting Channels*. The 1997 EIS evaluated two action plans in detail. In 2007, the Federal District Court, Eastern New Orleans District, enjoined the project and required the preparation of a Supplemental EIS to describe changes in existing conditions after Hurricane Katrina and to analyze impacts from the recommended plan and alternatives in light of the changed, post-Katrina conditions. The plan was revised and a new supplemental NEPA document was prepared entitled *Final Supplemental Environmental Impact Statement for the Inner Harbor Navigation Canal Lock Replacement Project*. The ROD for this Supplemental EIS was signed on May 20, 2009.

Although the proposed lock replacement plan is similar to the one recommended in the 1997 EIS, additional evaluation concerning the location and design of the confined disposal facility, as well as the method for disposal of contaminated sediments, were addressed in the 2009 Supplemental EIS. A community impact mitigation plan was implemented as part of the 1997 EIS Plan to avoid, minimize, and compensate for adverse impacts on socioeconomic resources in

the nearby neighborhoods, although since Hurricane Katrina, the population of nearby neighborhoods has changed dramatically.

On September 9, 2011, the USACE was ordered by a Federal judge in New Orleans to halt work on the IHNC Lock Replacement project until the USACE drafts a second supplemental EIS addressing the effects of the closure of the MRGO on the plan.

Southeast Louisiana (SELA) Project

The USACE is authorized to improve interior drainage and reduce damage from rainfall flooding in Orleans, Jefferson, and St. Tammany parishes. The project was authorized by the Fiscal 1996 Energy and Water Development Appropriations Act (Section 108), and the WRDA of 1996 (Section 533). Several NEPA documents, including EAs and Supplemental EAs, were prepared from 1996 to 2008 to identify work to be implemented under the SELA project authority. Construction began in 1998 and portions of this project are ongoing, while other portions are still in the planning stages. Portions of the project include canal enlargements, bridge replacements, and pump station improvements.

It is currently anticipated that 59 scheduled and funded construction contracts in Jefferson Parish and 20 scheduled and funded projects in Orleans Parish will be completed in 2017. In Orleans Parish, plans involve improving 12 major drainage lines, adding pumping capacity to one pump station, and constructing two new pump stations. In Jefferson Parish, plans include improvements to about 24 drainage canals, additional pumping capacity for four pump stations, and the construction of two new pump stations. A substantial amount of this work has been completed in Orleans and Jefferson parishes. The improvements support the parishes' master drainage plans and generally provide flood risk reduction on a level associated with a 10-year rainfall event, while also reducing damages for larger events. In Jefferson Parish, 50 contracts have been awarded to date, and 44 projects have been completed. In Orleans Parish, 13 contracts have been awarded, with nine having been completed.

Planned improvements in St. Tammany Parish include channel enlargements, bridge replacements, detention ponds, levees, and elevation of flood-prone structures. St. Tammany Parish plans would provide flood risk reduction for various rainfall events. The work is still unscheduled. The USACE is working with the parish administration to complete a study of the W-14 watershed in Slidell and to develop a plan for a parish-wide study.

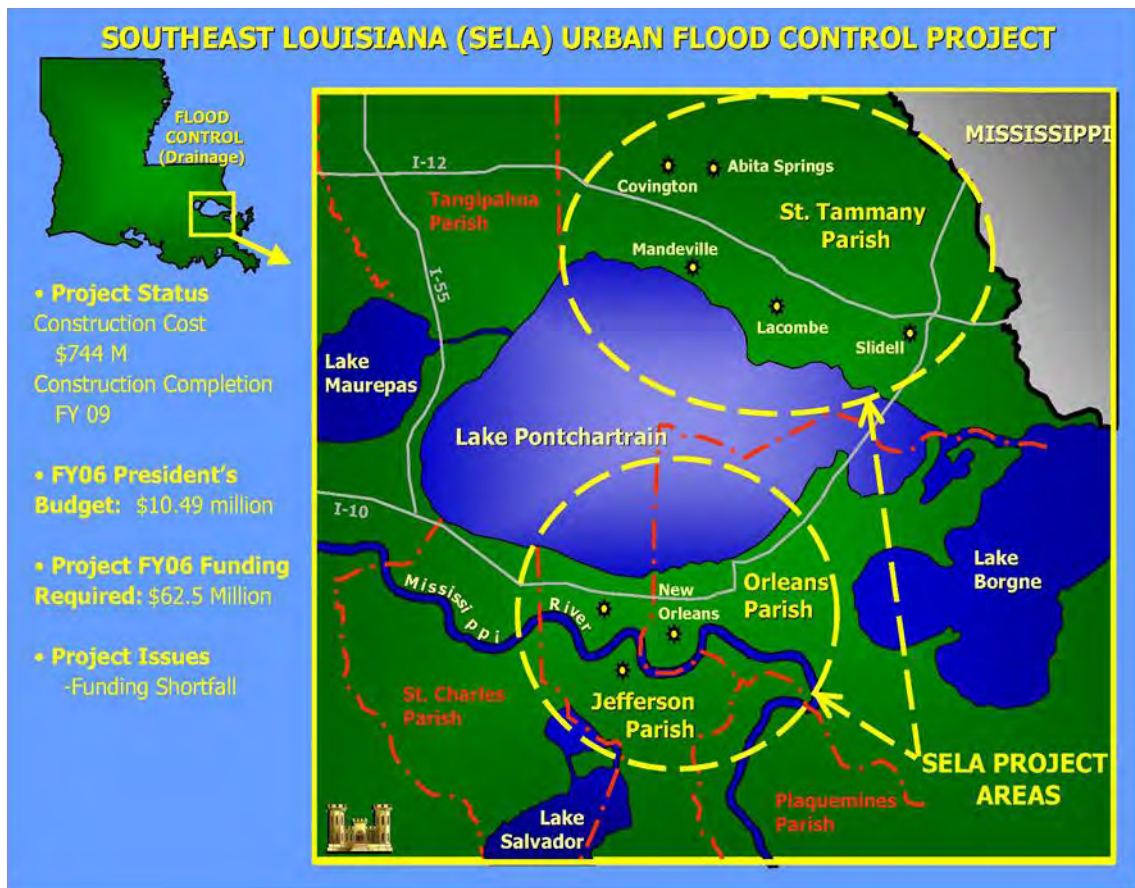


Illustration of SELA Project Area

Pump Station Stormproofing

The 4th Supplemental and 6th Supplemental authorized and appropriated funding for the stormproofing of 21 pump stations and the construction of safe houses at pump stations throughout Jefferson Parish. These actions are described in EA #454 and EA #475. Under the same authority, stormproofing was conducted at 22 pump stations in Orleans Parish, and is described in EA #474.

Major Coastal and Wetlands Restoration Projects

Major coastal and wetlands restoration and protection projects in the region are listed in appendix L and are components of the overall comprehensive regional planning efforts that are summarized below for southeastern Louisiana.

Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA)

The CWPPRA (P L 101-646, Title III) was the first Federal statutorily mandated restoration of Louisiana's coastal wetlands and the first stable source of Federal funds dedicated exclusively to the long-term restoration of coastal wetlands. CWPPRA provides for targeted funds to be used for planning and implementing projects that create, protect, restore, and enhance wetlands in coastal Louisiana. It was passed in 1990, and is authorized until 2019. By January 2011, 180 CWPPRA projects were approved, 89 were constructed, 63 are under construction or planned, and 28 have been de-authorized or transferred to another program. A list of CWPPRA projects with project descriptions is available at <http://www.lacoast.gov/projects>.

The CWPPRA Task Force is composed of the State of Louisiana and five Federal agencies: the U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS), National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), and the USACE. The Governor's Office of Coastal Activities represents the State of Louisiana. The CWPPRA Task Force annually develops a list of high-priority projects to be constructed. Seventeen such priority lists have been formulated. The projects funded by CWPPRA focus on marsh creation, restoration, protection, or enhancement. The Louisiana Department of Natural Resources had been responsible for monitoring the effectiveness of the wetlands restoration projects implemented under CWPPRA, but the Coastal Protection and Restoration Authority Board of Louisiana has now assumed this responsibility.

CWPPRA projects are generally small-scale localized projects to address projected future land loss in coastal Louisiana. Larger projects with more ecosystem-scale impacts may be constructed; however, many larger projects exceed the funding capacity and authorization period of CWPPRA. As discussed below, the Louisiana Coastal Area (LCA) initiative began in 2001 to

fill this need and seeks future WRDA authorization and funding for large-scale coastal restoration projects in Louisiana.

Louisiana Coastal Area Ecosystem Restoration Plan

The passage of CWPPRA in 1990 authorized and funded the Louisiana Coastal Wetlands Conservational Restoration Task Force to begin actions to curtail wetlands losses. In 1998, the State of Louisiana and five Federal agencies (USACE, USEPA, USFWS, NRCS, and NMFS) developed the *Coast 2050: Toward a Sustainable Coastal Louisiana* report, known as the Coast 2050 Plan. The plan combines elements of all previous efforts, along with new initiatives from private citizens, local governments, state and Federal agency personnel, and the scientific community. The underlying principle of the Coast 2050 Plan is to restore or mimic the natural processes that historically built and maintained coastal Louisiana. This plan proposed ecosystem restoration strategies that would result in efforts larger in scale than any that had been implemented in the past. The Coast 2050 Plan was the basis for the May 1999 report, entitled *Section 905(b) WRDA of 1986 Analysis Louisiana Coastal Area, Louisiana -- Ecosystem Restoration*. This reconnaissance-level effort evaluated the Coast 2050 Plan as a whole and determined Federal interest in proceeding to the feasibility phase. In 2000, it was envisioned that a series of feasibility reports would be prepared over a 10-year period.

The LCA Plan maximizes the use of restoration strategies that reintroduce historic flows of river water, nutrients, and sediment to coastal wetlands to maintain the structural integrity of the coastal ecosystem. An interagency project delivery team was assembled, composed of staff from the USACE, the State of Louisiana (the non-Federal sponsor), USFWS, NMFS, USEPA, U.S. Geological Survey, and NRCS; the *LCA Comprehensive Ecosystem Restoration Study* (LCA Study) was released for public comment in 2004. The LCA Study made several recommendations that were ultimately authorized by the WRDA of 2007. Based on the LCA Study, six additional project deliverables were added to the five near-term critical restoration projects recommended for specific authorization for implementation by the LCA Plan. The State of Louisiana has terminated the cost-share agreements on a number of authorized LCA projects.

Louisiana Coastal Protection and Restoration (LACPR)

Before Congress could consider authorizing the LCA Study's recommendations, Hurricanes Katrina and Rita hit Louisiana in 2005. Subsequently, the Energy and Water Development Appropriation Act of 2006 (P L 109-103), passed in November 2005, and the DOD *Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic and Influenza Act, 2006*, passed on December 30, 2005, as part of the Defense Appropriations Act [P L 109-148]. This Act directed the USACE to examine, assess, and present recommendations for a comprehensive approach to coastal restoration, hurricane storm damage reduction, and flood control. LACPR is a collaboration managed by the USACE that was tasked to generate a single technical report that provides guidance for Congress regarding hurricane risk reduction and coastal restoration. The scope of the LACPR is to address the full range of flood control, coastal restoration, and hurricane risk reduction measures available, including those needed to provide comprehensive "Category 5" storm protection.

The LACPR effort is coordinated with the State of Louisiana's Master Plan for coastal restoration and hurricane risk reduction and the Mississippi Coastal Improvements Program efforts to ensure a consistent systems approach to modeling storm events, data sharing, alternatives analysis, and lessons learned. Once the USACE and collaborators develop alternatives and priorities, the USACE and the State, through a joint LACPR/State team, will jointly coordinate those options and priorities with other Federal agencies, local entities, NGOs, and the public.

Louisiana Coastal Impact Assistance Program (CIAP)

The Energy Policy Act of 2005 (P L 109-58) was signed into law in August 2005. Section 384 of the Act establishes the CIAP, which authorizes funds to be distributed to Outer Continental Shelf (OCS) oil-producing and gas-producing states to mitigate the impacts of OCS oil and gas exploration, development, and production activities.

Under the CIAP, the Secretary of the Interior is authorized to distribute up to \$250 million per fiscal year to the producing states of Alabama, Alaska, California, Louisiana, Mississippi, and

Texas for FY 2007 through FY 2011 based upon allocation formulas prescribed by the Act. The goals of the Louisiana CIAP are to:

- 1) implement, support, and accelerate effective and timely coastal conservation and restoration projects; and
- 2) implement, support, and accelerate coastal infrastructure projects that mitigate onshore impacts from OCS production.

The conservation and restoration objectives of the Louisiana CIAP are to implement Coast 2050, CWPPRA projects, and LCA Plan features that can be initiated in the near term, and to implement a coastal forest conservation and restoration initiative. Additionally, CIAP will support projects to benefit wetlands and aquatic habitats in inland portions of coastal parishes and conduct monitoring and related science-support activities. All state CIAP restoration projects have had some level of work initiated. As of August 2011, 88 percent of all CIAP projects in Louisiana are under way or completed.

Louisiana Comprehensive State Master Plan for a Sustainable Coast (State Master Plan)

The State Master Plan was developed to fulfill the mandates of Act 8, which was passed by the Louisiana Legislature in November 2005 and signed into law by the Governor of Louisiana. The Act created the **Coastal Protection and Restoration Authority (CPRA)** and charged it with coordinating the efforts of local, state, and Federal agencies to achieve long-term and comprehensive coastal protection and restoration. In so doing, the CPRA must integrate what had previously been discrete areas of activity: flood control and wetlands restoration. Act 8 also requires that the CPRA establish a clear set of priorities for making comprehensive coastal protection a reality in Louisiana. The State will use new programs, as well as existing programs such as the CWPPRA, the LCA, and the CIAP, to implement the State Master Plan. The State Master Plan is to be updated every 5 years. The first State Master Plan was presented to the Louisiana Legislature in 2007 and the updated 2012 State Master Plan was passed by the Louisiana Legislature in May 2012.

The State Master Plan for hurricane protection and ecosystem restoration presents a conceptual vision of a sustainable coast based on the best available science and engineering. It builds upon past efforts and existing programs to provide this comprehensive vision and serves to unite the work of ongoing programs toward a common goal. The State Master Plan presents a series of recommended hurricane protection and coastal restoration measures, as well as a management strategy for implementing the measures. The measures contained in the plan can be broken down into the following three groups, based upon the broad outcomes they deliver:

- Restoring Sustainability to the Mississippi River Delta
- Restoring Sustainability to the Atchafalaya River Delta and Chenier Plain
- Hurricane Protection

4. CED Organization and Results

The CED provides a description and summary of the HSDRRS, the affected environment, HSDRRS impacts, cumulative HSDRSS impacts, regional cumulative impacts, and mitigation; it contains 12 sections and various appendices.

Affected Environment

In order to evaluate the impacts or consequences of the HSDRRS on the natural and human environment, the USACE first had to define the baseline conditions for all affected resources (biological, physical, and human), also called the **affected environment**. The USACE established the existing conditions for each resource, which provided a basis for comparison with the impacts of the Proposed Action in each IER and, subsequently, in this document.



HSDRRS sheet pile construction activities

The Organization of the CED



The HSDRRS project area in southeast Louisiana within St. Charles, Jefferson, Orleans, St. Bernard, and Plaquemines parishes is predominantly low in elevation, and much of the area is below sea level. The HSDRRS project area is bisected by the Mississippi River and is bounded by Lake Pontchartrain to the north, Lake Borgne and Breton Sound to the east, and Bayou Trepagnier and Cross Bayou to the west, and to the south there are numerous lakes, bayous, fragmented marsh, and wetlands, ultimately terminating in the Gulf of Mexico (see appendix D). The City of New Orleans and the surrounding metropolitan area is a mixture of highly urbanized and industrial areas abutting wooded lands, wetlands, numerous man-made canals, bayous, and other watercourses, which serve as a rich landscape for wildlife.

Much of the HSDRRS project area was formerly wetlands (cypress swamps and marshes). Wetlands can be defined as areas where water saturation is the dominant factor determining the characteristics of soil development and types of plant and animal communities living in the area. Water is present either at or near the surface of the soil or within the root zone all year or at various durations throughout the year, including the growing season. The prolonged presence of water results in the occurrence of plants that are adapted to survive under saturated conditions and can grow in the soils that form under flooded and saturated conditions (hydric soils). As the New Orleans Metropolitan Area grew and the constructed levees were built ever higher, water was drained from swamps and marshes by canals and pumping, and dredged material, including peat and mud, was used to elevate the area for habitation. Land inside the HSDRRS levees is continually subsiding due to dewatering of peat deposits, growth fault slippage, and man-made activities, often resulting in surface elevations at or below sea level. Due to these low elevations within the HSDRRS project area, a forced drainage system is required, which pumps water to Lake Pontchartrain, the GIWW, and numerous other drainage canals during rain and storm events.



Biological Resources

- Threatened and Endangered Species (T&E)
- Essential Fish Habitat (EFH)
- Fisheries
- Uplands
- Water Resources
- Wetlands
- Wildlife Resources



Physical Resources

- Aesthetics
- Air Quality
- Hazardous, Toxic, and Radioactive Waste (HTRW)
- Noise
- Soils
- Transportation



Human Resources

- Cultural Resources
- Recreational Resources
- Socioeconomic Resources and Environmental Justice (EJ)

Impacts of the HSDRRS

The “cause and effect” relationship between the Proposed Action and other alternative actions (including the No Action alternative) and the impacts on the human and natural environment were considered and analyzed in the IERs. Within this document, the analyses were compiled from each individual IER; additional analyses based on completed construction information have been added and then synthesized by sub-basin for clarity and ease of discussion.

As the bulk of the HSDRRS construction is complete, all of the HSDRRS Proposed Actions in IERs completed by November 15, 2010, and construction contracts completed by July 2011 are described as completed work in the CED. However, future levee lifts required to maintain the 100-year level of risk reduction over the next 50 years are analyzed as proposed future work and



HSDRRS construction of the Borgne barrier

discussed as the HSDRRS 2057 project components. In addition, borrow sites that have not been utilized for the HSDRRS 2011 work, as of July 2011, are classified as proposed potential future work in the CED with future impacts should they ultimately be used.

In table 2, the environmental consequences are summarized by sub-basin and the intensity of the impacts shown, if known. Although the USACE avoided or minimized impacts to the greatest extent practicable, mitigation measures will be implemented to compensate for unavoidable impacts to natural resources. Although not shown in table 2, beneficial impacts also occurred from the implementation of the HSDRRS 2011 and are discussed in the CED.

In addition to the adverse environmental consequences within the HSDRRS project area, there were HSDRRS 2011 impacts on the human and natural environment in areas within other parishes in Louisiana and in Hancock County, Mississippi, which are shown in table 3.

CEMVN Mitigation

The USACE implemented mitigation measures to avoid or minimize the impacts on sensitive resources. Mitigation measures are described in detail in section 5.0 of the CED. Some mitigation measures were documented in the IERs and Decision Records. Mitigation measures were determined by the USACE through coordination with various state and Federal agencies, the public, and NGOs. Additional mitigation measures were identified during the construction phase and implemented at that time. Additional compensatory mitigation projects are currently being developed and will be evaluated in mitigation-specific IERs.

Federal laws such as the Clean Water Act require wetland impacts to be avoided if practicable, or minimized if impacts are unavoidable and then mitigated through compensatory mitigation. Mitigation for impacts on wetlands and non-jurisdictional BLH under the CEMVN Mitigation Program will compensate for unavoidable impacts and the mitigation may be accomplished through restoration, creation, enhancement, and preservation of wetlands and non-jurisdictional BLH. Mitigation for non-jurisdictional BLH impacts associated with contractor-furnished borrow sites is being accomplished by contractors through the purchase of mitigation credits from mitigation banks.

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Table 2. Intensity of the HSDRRS 2011 Permanent Adverse Impacts by Sub-basin¹

Resource	Negligible Impacts									Minor Impacts						Moderate Impacts						Major Impacts							
	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche		
Soils									X	X	X	X				X	X											X	
Water Quality												X			X		X		X	X	X								
Wetlands			X																X	X	X	X							
Uplands	X	X	X			X	X	X					X	X															
Fisheries									X			X	X	X	X	X	X	X		X									
Wildlife		X		X					X			X			X	X	X	X					X						
EFH	X					X	X	X				X		X					X				X						
T&E Species	X	X	X	X	X	X	X	X	X																				
Cultural	X	X	X	X	X	X	X	X	X																				
Recreational	X				X	X	X				X	X	X					X	X										
Aesthetics											X		X	X	X			X		X				X		X			
Air Quality	X	X	X	X	X	X	X	X	X																				
Noise	X	X	X	X	X	X	X	X	X																				
Transportation																			X	X	X	X	X	X	X	X	X		
Socioeconomic	X	X	X	X	X	X	X	X	X																				
HTRW	X	X	X	X	X	X	X	X	X																				

Note: Within the CED, Cultural Resources, Socioeconomics and EJ, and Air Quality were presented by parishes within the HSDRRS project area.
¹ For HSDRRS actions described by IERs completed by November 15, 2010, and construction contracts implemented by July 2011.

Table 3. Intensity of the HSDRRS 2011 Permanent Adverse Impacts outside the HSDRRS Project Area (Borrow Sites)¹

Resource	Negligible Impacts										Minor Impacts										Moderate Impacts										Major Impacts																											
	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock														
Soils																																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Quality	X	X	X	X	X	X	X	X	X	X																																																
Wetlands	X	X	X	X	X	X	X	X	X	X																																																
Uplands											X			X		X		X						X	X		X		X		X	X	X																									
Fisheries	X	X	X	X	X	X	X	X	X	X																																																
Wildlife	X	X	X	X		X	X		X	X						X				X			X												X																							
EFH	X	X	X	X	X	X	X	X	X	X																																																
T&E Species	X	X	X	X	X	X	X	X	X	X																																																
Cultural	X	X	X	X	X	X	X	X	X	X																																																
Recreational	X	X	X	X	X	X	X	X	X	X																																																
Aesthetics		X	X						X	X	X			X	X	X	X	X	X																																							
Air Quality	X	X	X	X	X	X	X	X	X	X																																																
Noise	X	X	X	X	X	X	X	X	X	X																																																
Transportation											X		X											X		X	X	X	X	X	X	X	X	X	X																							
Socioeconomic	X	X	X	X	X	X	X	X	X	X																																																
HTRW	X	X	X	X	X	X	X	X	X	X																																																

¹ For HSDRRS actions described by IERs completed by November 15, 2010, and construction contracts implemented by July 2011.

As of September 2011, impacts on approximately 117.15 acres (65.97 AAHUs) of non-jurisdictional BLH forest were mitigated in association with the HSDRRS excavation of contractor-furnished borrow areas. The USACE's overall objective for compensatory mitigation efforts for marsh, swamp, wetlands, and non-jurisdictional BLH is to replace the functions and values of the lost habitats. Other mitigation efforts included avoidance and minimization of impacts through the design process and/or through methods of construction, such as the use of best management practices or the avoidance of sensitive natural areas during certain times of the year.

Some mitigation efforts implemented by the CEMVN are:

- Avoidance methods and the use of buffer and “No-work” zones for the minimization of impacts on various resources, including wetlands and non-jurisdictional BLH
- Creation, restoration, or enhancement of wetlands and non-jurisdictional BLH
- Cultural and biological monitoring during construction activities
- Use of signage, temporary rerouting of roads during construction, and installation of temporary turn lanes near construction areas to minimize transportation impacts
- Use of dust suppression methods such as watering of construction site for the minimization of impacts on various resources
- Pre-construction nesting bird surveys conducted by the USFWS and the USACE and avoidance of active nests
- Use of silt curtains at construction areas and other best management practices
- Containment of fuel and construction-required chemicals for minimization of impacts on various resources
- Utilizing specific construction times to avoid threatened and endangered species
- Prevention of colonial nesting birds from establishing active nests within the project construction right-of-way. This was done to prevent nesting close to the noise and



Examples of signage and silt curtain mitigation measures

disturbance caused by the construction activities. If the birds were allowed to establish nests in these areas, they could ultimately abandon eggs or hatchlings.

- Purchase of mitigation credits from mitigation banks by contractors to mitigate for contractor-furnished non-jurisdictional BLH impacts from borrow site excavation activities

Mitigation for impacts on open water habitats and the use of Wetland Value Assessment models to evaluate such impacts will follow guidelines being developed cooperatively between CEMVN, NMFS, and USFWS (see appendix S). In general, mitigation for impacts on open water habitats would typically be limited to any fill that would permanently affect open water habitats classified as EFH or containing submerged aquatic vegetation (SAV); any excavation impact on open water habitats containing SAV, or designated as EFH where excavation would create permanent anoxic conditions in the affected area; any fill or excavation impact on open water habitats containing seagrasses; or any fill or excavation in open water habitat that is designated as oyster seed grounds by Louisiana Department of Wildlife and Fisheries. However, mitigation for impacts on open water habitats would not typically be required for dredging in open water areas where no SAV is present (even if the affected area is designated as EFH), for filling of an open water area such that the area would not be converted to non-aquatic habitat, or where the impact on open water habitats would be less than 1 acre within a single open water area.

Future Operations and Maintenance

Local residents, businesses, and industries are dependent on the proper maintenance and operation of the HSDRRS components for flood risk reduction. The consequences of neglect or failure to operate the system correctly could be devastating for residential inhabitants and the overall region. Although the CEMVN was authorized to design and construct the HSDRRS, it is the responsibility of the non-Federal sponsor for the projects to **operate, maintain, repair,**



Example of HSDRRS sector gate

replace, and rehabilitate (OMRR&R) the entire HSDRRS. Specifically, the non-Federal sponsor is required to conduct OMRR&R at no cost to the Federal government, in a manner compatible with the authorized purpose, and in accordance with applicable Federal and state laws, and according to specific directions provided by CEMVN in the OMRR&R Manuals and Water Management Plans.

Through an agreement reached in 2006, the State of Louisiana empowered the CPRA (now the Coastal Protection and Restoration Authority Board of Louisiana) to act as the non-Federal sponsor for the HSDRRS in the Greater New Orleans Metropolitan Area and in southeastern Louisiana and to carry out all functions necessary to serve as the single state entity for these responsibilities. The CPRA entered



Example of an earthen levee in southeast Louisiana

into several project partnering agreements to aid in the administration of these responsibilities with the following local entities:

- The Southeast Louisiana Flood Protection Authority
 - West (West Jefferson and Algiers Levee Districts)
 - East (East Jefferson, Orleans, and Lake Borgne Basin Levee Districts).
- The Pontchartrain Levee District
- Plaquemines Parish
- St. Charles Parish

Public Involvement and Agency Coordination

A key component of NEPA and the Emergency Alternative Arrangements process is public input, coordination, and cooperation. The cornerstone of the public involvement process was the many public meetings held throughout the Greater New Orleans Metropolitan Area focusing on individual HSDRRS projects. Specifically, between February



Example of an HSDRRS informational public meeting

2007 and December 2011, the CEMVN held 200 public meetings, scoping meetings, workshops, and focused design meetings to allow the public to be involved in the HSDRRS planning and construction process. NGOs were also kept abreast of the HSDRRS planning and construction efforts through a series of 11 meetings hosted by the CEMVN from April 2008 to March 2011. The CEMVN utilized a vast number of public meetings, partnering sessions, special presentations, and websites to aid in communicating their plans to the public. To assist in providing the public with as much information as possible through the design and construction process, CEMVN hosted over 6,500 site visits and field trips with the public, neighborhood groups, interested parties, and agency personnel, and maintained a construction hotline that was answered 24 hours a day (877-427-0345).

CEMVN actively listened and responded to the public through these numerous meetings and site visits. Many common concerns of the public have changed through time, indicating that CEMVN has been successful at responding to public concerns and addressing public comments. Comments during meetings at the beginning of the HSDDRS planning process included concerns about adequate available funding for construction, differing start times for projects leading to perceived unequal risk reduction for residents based on location, interest in how lawsuits could be filed, why some areas flooded while other areas did not, and differing structural elevations based on location in the system. Comments expressed during more recent meetings were focused on specific project design issues near the location of the meeting, or were about aesthetics, noise, construction traffic, and conditions of borrow sites.

A public scoping process was performed by the CEMVN, as an integral part of the NEPA Alternative Arrangements, to gather information concerning human and natural resources and determine the public's major concerns. Nine scoping meetings were held between March and April 2007 at various locations within the HSDRRS project area, and a public scoping meeting was held specifically for the CED on September 2, 2009. Overall, a total of 11 general categories of questions were recorded from the public scoping meetings' participants. The general categories of questions, along with the relative frequency of each question, are shown in figure 5, and scoping meeting summaries are provided in appendix E.

Prior to public meetings, the CEMVN provided notices in local and national newspapers, news releases (routinely picked up by television and newspapers in stories and scrolls), e-mails, and mail notifications to stakeholders for each public meeting. To aid in making the HSDRRS information readily available to the public, a website called www.nolaenvironmental.gov was created specifically to be the clearinghouse for all public notices, reports, IERs, agency coordination, and decision records for the HSDRRS. Other valuable information and the HSDRRS descriptions, as well as animated presentations, were also shared on the CEMVN website at <http://www.mvn.usace.army.mil/>. Each draft IER and IER supplemental was posted on the www.nolaenvironmental.gov website for a 30-day public review period.

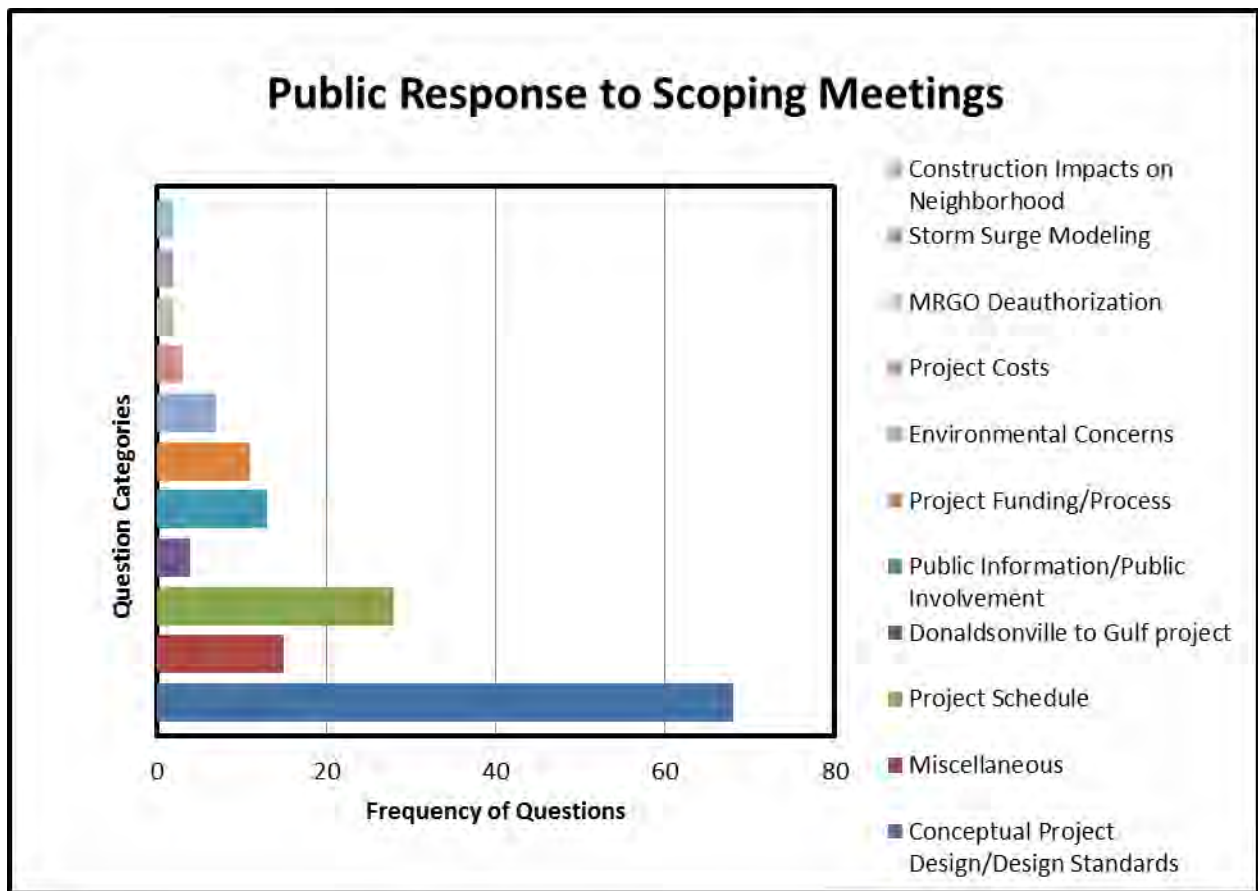


Figure 5. Public Response to Scoping Meetings*

* In June 2012, the Donaldsonville, Louisiana to the Gulf of Mexico Feasibility Study was terminated due to low benefit-to-cost ratios for all levee alternatives studied.

Notices of availability for public review of IERs were mailed and emailed to all interested parties. This mailing list includes approximately 3,000 individuals and was populated by incorporating everyone that attended IER public meetings and submitted comments or questions. Further, a comment/question button was placed on the website that is monitored, and responses to comments and questions were provided within approximately 24 hours. During public meetings, responses to comments were directly provided when possible, and written IER comments were addressed and provided to the public within approximately 2 weeks of signing Decision Records.

Throughout this overall public involvement effort, the USACE also educated the public about flood risk. Although the USACE is reducing the risk of hurricane and storm damage, as authorized by Congress, not all risk to the public can be eliminated, and everyone shares the responsibility for reducing that risk. This can be accomplished through insurance, zoning and building codes, coastal protection and restoration, and compliance with mandatory evacuations.

REDUCING RISK



The USACE consulted or coordinated with other Federal, state, and local agencies, as shown in table 4. In addition, Native American Tribal Nations and NGOs were brought into the coordination and public involvement effort for the HSDRRS, as listed in tables 5 and 6.

Table 4. Agencies Consulted or Coordinated with during the HSDRRS Implementation

Federal	State	Local
Federal Emergency Management Agency	Coastal Protection and Restoration Authority of Louisiana	Jefferson Parish
Natural Resources Conservation Service	Department of Cultural, Recreation, and Tourism	Orleans Parish
National Park Service	Department of Environmental Quality	Orleans Levee District
National Ocean Atmospheric Association	Department of Health and Hospitals	Plaquemines Parish
NOAA National Marine Fisheries Service	Department of Natural Resources	Port of New Orleans
U.S. Coast Guard	Department of Transportation and Development	St. Bernard Parish
U.S. Environmental Protection Agency	Department of Wildlife and Fisheries	St. Charles Parish
U.S. Fish and Wildlife Service	Governor's Executive Assistant for Coastal Activities	New Orleans Sewerage and Water Board
Federal Highway Administration	State Historic Preservation Officer	
U.S. Geological Survey		

Table 5. Tribal Nations Consulted with during the HSDRRS Implementation

Tribal Nations
Alabama Coushatta Tribe of Texas
Caddo Nation of Oklahoma
Chitimacha Tribe of Louisiana
Choctaw Nation of Oklahoma
Coushatta Tribe of Louisiana
Jena Band of Choctaw
Mississippi Band of Choctaw Indians
Seminole Nation of Oklahoma
Seminole Tribe of Florida
Tunica-Biloxi Tribe of Louisiana
Quapaw Tribe of Oklahoma

Table 6. Other Organizations Coordinated with during the HSDRRS Implementation

Non-Governmental Organizations	
American Rivers	Louisiana Sea Grant
City of Covington Tree Board	Louisiana Wildlife Federation
Coalition to Restore Coastal Louisiana	Make It Right
Coastal Conservation Association	National Wildlife Federation
Ducks Unlimited	Nicholls state University
Environmental Defense Fund	Orleans Audubon Society
Gulf Restoration Network	Sierra Club
Lake Pontchartrain Basin Foundation	Southern Louisiana Earth Science Research Center Foundation
Louisiana Audubon Council	The Nature Conservatory
Louisiana Bayoukeeper	Tulane University
Louisiana State University, Coastal Restoration and Enhancement through Science and Technology Program	Neighborhood/Civic/Property Owners Associations

5. Cumulative Impacts Summary

The NEPA requires a Federal agency to consider not only direct and indirect impacts of a proposed action, but also cumulative impacts of the action. A cumulative impact is defined as *the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 Code of Federal Regulations 1508.7)*. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The purpose of the CED is to provide a description of the cumulative impacts of all HSDRRS projects completed in the Greater New Orleans Metropolitan Area in Louisiana; to analyze the indirect cumulative impacts resulting from the HSDRRS projects in combination with proposed and other reasonably foreseeable projects in southeast Louisiana; to give an overview of the mitigation process and specific mitigation measures; to outline future operations and maintenance requirements; and to document coordination and consultation activities in compliance with applicable environmental laws.

The Independent External Peer Review (IEPR) process provides an independent technical peer review for design and construction efforts of the HSDRRS under Section 2035 of WRDA 2007. The initial IEPR plan was approved in September 2008, and proposed to evaluate 19 unique features and three general system application documents (Design Guidelines, Armoring Manual, and Quality Management Plan). The first revision of the IEPR was done to eliminate duplicate features, and to refocus to a higher level of review of unique features, innovative techniques, design assumptions, and changes through project phases (design, construction, operations and maintenance, monitoring). A second revision of the IEPR proposes to evaluate 10 unique features and activities and seven system application documents (Design Guidelines, Armoring Manual, Spiral Weld Pipe Study, Barge Impact Study, 1% Design Report, 2010 HSDRRS Design Guidelines, and Harvey and Algiers Canal 100-year Alternative). Some features were added at the request of the non-Federal Sponsor. The estimated completion date of IEPR for all HSDRRS features, products, and activities is 2014. This process includes completion of

individual reviews, completion of summary reports, approval of peer review package, and posting for public release by Mississippi Valley Division.

As previously discussed, Hurricane Katrina damaged substantial portions of the hurricane risk reduction system and flooded most of the project area. The Insurance Information Institute has estimated that insured losses from Hurricane Katrina totaled \$40.6 billion in six states, and in Louisiana insured losses were estimated at \$25.3 billion; much of those insured losses will be a component of regional rebuilding efforts. Although it is unknown how many structures will be rebuilt in southeast Louisiana and throughout the Gulf Coast over the next 5 to 10 years, a large-scale rebuilding effort is under way.

The impacts of the HSDRRS construction associated with raising levees, floodwalls, floodgates, and new structures to provide 100-year level of risk reduction are described in the IERs. Collectively, the HSDRRS construction had, and continues to have, a cumulative beneficial impact on the socioeconomics of southeast Louisiana. Short-term cumulative socioeconomic benefits are realized through the expenditure of well over \$14 billion in the region for HSDRRS construction. Damage to impacted features of LPV, WBV, NOV, and certain non-Federal levees was immediately repaired through the Task Force Guardian program, and all construction efforts for Task Force Guardian were completed by the end of November 2006 at a cost of approximately \$1 billion. All construction work on the HSDRRS started after the Task Force Guardian effort was completed, and is anticipated to continue through August 2014. In the short term, these construction projects directly provide jobs, benefit businesses through the purchases of materials and supplies, and provide sales tax revenues to local governments. In the long term, providing the 100-year level of risk reduction to communities in southeast Louisiana improved the confidence of residents and the business community, and generates further interest in redevelopment of storm-damaged neighborhoods. The cumulative economic benefits of the long-term confidence that risk reduction brings are not truly quantifiable, but providing greater safety for everyone with investment interests in southeast Louisiana is a substantial cumulative economic benefit to Louisiana and the U.S.

There is a cumulative significant impact on soils in the region, primarily due to the permanent loss of up to 5,181.3 acres of prime farmland soils, much of which was anticipated to be used as borrow material for risk reduction features. However, many of the proposed borrow sites have not yet been utilized for construction. Short-term cumulative adverse impacts on transportation are caused by increased construction traffic, congestion from transporting materials



Huey P. Long Bridge Transportation Project

(primarily borrow material) to project construction locations, and temporary road closures resulting from the implementation of numerous highway improvement projects, the HSDRRS improvements, and local redevelopment. Although construction-related traffic delays ceased as construction projects were completed, damage to pavement from increased truck traffic is long-term. Short-term cumulative impacts on residents from construction and traffic noise also occurred from the combination of the HSDRRS improvements and ongoing redevelopment construction activities and transportation improvement projects. The renovation of existing structures and new residential and commercial construction in now-vacant lots added to the overall noise levels during the HSDRRS implementation. Large-scale construction projects have had short-term cumulative impacts on aesthetics and recreational resources from the presence of construction equipment; however, no significant long-term cumulative impacts have occurred for any of these resources. Activities from other ongoing and planned regional redevelopment and transportation projects may result in cumulative adverse impacts on known or unknown cultural resources, but the implementation of the HSDRRS and other flood risk reduction projects provides cumulative beneficial impacts on cultural resources through added storm-damage reduction.

An estimated cumulative total of 1,656.5 acres of wetlands and 3,625.8 acres of non-jurisdictional BLH would be directly impacted by the HSDRRS construction and use of borrow sites (including impacts from future levee lifts); therefore, the cumulative impacts on wetlands and BLH in the region are anticipated to be substantial, primarily because nearly all risk reduction projects, as well as many transportation projects, affected wetland and BLH habitats in

southeast Louisiana. When combined with the high rate of wetland loss in coastal Louisiana, the cumulative impacts are long-term and likely permanently altered these habitats in ways that are not quantifiable. However, impacts on these habitats, including wetlands and non-jurisdictional BLH, will be mitigated through restoration or creation of wetlands and non-jurisdictional BLH. Compensatory mitigation is a component of all projects in the region, including the HSDRRS, that have unavoidable impacts on wetlands; it ensures that no net loss of wetland functions occurs. Mitigation bank credits are being purchased by contractors concurrently with impacts on non-jurisdictional BLH at contractor-furnished borrow sites. However, even with compensatory mitigation in place, there would be a temporary cumulative loss of function of wetlands and non-jurisdictional BLH habitats until the mitigation sites have reached maturity.

Wildlife and fisheries utilize wetlands, non-jurisdictional BLH, and aquatic habitats for portions of their life cycles and are also cumulatively adversely impacted by the implementation of the various construction projects associated with the HSDRRS, transportation improvements, and redevelopment in the region. Compensatory mitigation for wetlands, non-jurisdictional BLH, and aquatic



Purple iris in southeast Louisiana swamp

impacts will reduce the cumulative impacts on wildlife and fisheries, but will not eliminate the impacts, especially the temporal cumulative loss of rearing, resting, and foraging habitats.

The USACE, other Federal agencies with large-scale projects in the region, such as FEMA, Federal Highway Administration, and U.S. Department of Housing and Urban Development, and state and local agencies, have worked together to minimize and mitigate long-term impacts on human and natural resources, and mitigate short-term impacts on transportation and noise. Further, impacts from borrow excavation at borrow sites will be substantially less than predicted, since only 25 of the 68 environmentally cleared borrow sites have been utilized for HSDRRS construction as of July 2011. Although collectively the short-term and permanent cumulative impacts cannot be totally mitigated, the socioeconomic benefits for residents (both those

currently residing in southeast Louisiana and those displaced that desire to return home) and businesses that want to continue to thrive in the region greatly outweigh the cumulative adverse impacts. National benefits include the reduction of flooding risk for port facilities along the Mississippi River in New Orleans, which move approximately 500 million tons of cargo annually, and include several of the Nation's largest ports by tonnage, including the Port of South Louisiana and the Port of New Orleans. Further, New Orleans is an important international tourist and convention destination, and reduced flooding risk benefits the economic status of tourism for both the local economy and the Nation.

6. Conclusions

The devastation to New Orleans and the Gulf Coast from Hurricanes Katrina and Rita included the loss of over 1,800 lives; it temporarily and permanently displaced many thousands of residents, and resulted in estimated property damages in excess of \$40 billion in New Orleans and as much as \$100 billion along the Gulf Coast. To reduce the risk of hurricane and storm damage in metropolitan New Orleans, the USACE has embarked on the largest civil works project in USACE history to increase public safety, and reduce property damage from storm surge in southeast Louisiana. The USACE has documented the scale, scope, and cost of this endeavor through the NEPA Alternative Arrangements process in IERs and the CED, and will continue through future supplement(s) to the CED.

Since the planning for the HSDRRS improvements began, the USACE has engaged the public through 10 scoping meetings, 200 public meetings, workshops, and design meetings, and over 6,500 field trips. The goals of the public awareness efforts were to help plan and explain the 100-year level of risk reduction project components; to gather input on how to minimize impacts on residents, businesses, transportation, and biological resources; and to provide updates on construction progress. The USACE has described to the public the proposed actions in various IERs and in this document and has evaluated impacts on the natural and human environment. Cumulative short-term impacts have occurred due to HSDRRS and regional project construction activities, and include impacts on transportation, noise, air quality, and aesthetics. As the construction activities associated with the HSDRRS, other regional flood and storm risk

reduction projects, and re-building cease, these temporary impacts will also cease. Long-term permanent cumulative impacts on soils, including prime farmland soils, habitat supporting wildlife, wetlands and non-jurisdictional BLH, have occurred regionally. Compensatory mitigation will reduce the impacts on biological resources from these regional projects, but impacts on soils are permanent and these impacts cannot be reduced through mitigation. The USACE continues to develop plans to compensate for those short-term and permanent impacts on the natural environment. Through this process, the USACE has pursued its goal of providing the level of risk reduction needed for public safety and desired by the community, while minimizing permanent losses on the human and natural resources that are valued in the region and throughout the U.S.

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PREFACE

The Comprehensive Environmental Document (CED) describes all of the components of the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS) previously described in Individual Environmental Reports (IERs), which were prepared to meet the requirements of the Council on Environmental Quality (CEQ)-approved National Environmental Policy Act (NEPA) Emergency Alternative Arrangements (Federal Register Volume 72, Number 48, Tuesday, March 13, 2007) and the CEQ's NEPA Regulations (40 Code of Federal Regulations [CFR] §1500-1508). The purpose of the CED is to describe and evaluate the cumulative impacts of the 217 miles of the HSDRRS. The CED provides a description of the cumulative impacts for other projects proposed in southeastern Louisiana, the mitigation process and mitigation measures implemented during the HSDRRS construction, future operations and maintenance requirements, coordination and consultation activities, and compliance with all applicable environmental laws. The CED also contains updated information for individual IERs that had incomplete or unavailable data at the time the U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN) Commander signed a Decision Record.

The cumulative impacts analysis for this CED incorporates information from IERs completed prior to November 15, 2010, as well as from construction implemented before July 2011. This is the first version of the CED. As project construction, the mitigation process, long-term monitoring, and adaptive management commitments are completed supplements to the CED will be presented to the public. Appendix I of the CED contains lists of the IERs included in the cumulative impacts analysis, as well as those not analyzed in the CED.

Recent storm events have provided an opportunity to evaluate the performance and impacts of implementation of the HSDRRS. That evaluation is summarized in this Preface.

Evaluations of Expected Hurricane Storm Damage Risk Reduction System Performance

During the design of the HSDRRS, multiple models were run to describe the positive and potential unintended effects of the system on storm surge elevations. The models applied to determine the levee and structure heights to provide the 100-year level of risk reduction were initially developed as part of the Interagency Performance Evaluation Task Force (IPET) work to examine the response of the southeast Louisiana hurricane protection features to Hurricane Katrina (IPET 2009). The same models have also been applied to the Louisiana Coastal Protection and Restoration Study (LACPR; USACE 2009), as well as in the FEMA flood mapping study for Louisiana. These models have been extensively peer-reviewed. The USACE applied these models to estimate wave run-up (additional water elevation due to the impact of waves near the shore interacting with individual structures) and overtopping and conducted further analysis to determine the conditions that might occur 50 years in the future (the year 2057) due to subsidence (the sinking of the land) and sea-level rise, and to provide design guidelines for the HSDRRS. Additionally, results of the modeling efforts were used to determine the impacts of the HSDRRS on the potential for increased flooding in areas outside the system.

As part of the LACPR study, hydrodynamic modeling was performed to provide engineering-based estimates on extreme surge and wave heights for evaluation of both existing and alternative future conditions to the levee design. The LACPR 2010 base condition, which represented the proposed improvements to the HSDRRS that were expected to be completed by 2010, was part of this analysis. The sensitivity analyses (an analysis of how the variation in a model's output can be allocated to different sources of model input variation, which is an integral part of hydraulic modeling) conducted using LACPR 2010 base condition model simulations indicated that the HSDRRS components reduce risk to the greater New Orleans area. The Inner Harbor Navigation Canal (IHNC) Storm Surge Barrier Modeling Study results also indicate a reduction in 100-year water levels in the Inner Harbor Navigation Canal (IHNC) and Gulf

Intracoastal Waterway (GIWW) by more than 8 feet. These analyses also indicated that increases in 100-year water levels (i.e., a flood elevation that statistically has a 1 percent chance of being equaled or exceeded in any given year) outside the system are typically less than 0.3 foot near the surrounding communities (USACE 2012).

The Caernarvon Floodwall is a short piece of floodwall that ties the Lake Pontchartrain and Vicinity (LPV) alignment to the Mississippi River Levee (MRL) alignment at the St. Bernard and Plaquemines Parish line. An increased flooding analysis was conducted separately for the Caernarvon Floodwall. Results suggest that no increased flooding would occur in the surrounding area due to the Caernarvon Floodwall because no increase in water surface elevation during storm events is predicted by the model (USACE 2012).

A sensitivity analysis was conducted separately for the GIWW West Closure Complex (WCC) that included the change in peak water levels during storm events due to blocking of the canal, the increase in water levels due to the pump outflow downstream from the WCC pump station, and predicted water levels under various historical storm scenarios (i.e., Juan, Gustav, Isidore, and Lee). For all storm surge scenarios evaluated, the difference in maximum surge is small (0.2 foot or less). The average difference in maximum surge was predicted to be 0.03 foot. For the WCC pump operation, the maximum increase in water surface elevation downstream of the pump station was 0.3 foot nearest the WCC barrier (which is located in an undeveloped area), and 0.2 foot at points representing communities downstream of the WCC. The analysis of the WCC under various historical storm scenarios predicted that the maximum increase in water surface elevation near points representing communities was 0.1 foot, and at most points the water surface elevation increase was less than 0.1 foot (USACE 2011, USACE 2012).

Overall, the sensitivity analyses conducted from the LACPR 2010 condition modeling determined that the HSDRRS components reduce storm surge risk for the Greater New Orleans area and significantly reduce the 100-year water levels in the IHNC/GIWW. The modeling determined that increases in 100-year water levels outside the HSDRRS are typically less than 0.3 foot near communities, which falls within the model's range of uncertainty (i.e., range of error in the model's predictive ability). Further, the sensitivity analysis conducted to evaluate changes in water levels due to the presence of the WCC predicted that the operation of the WCC would increase water elevation by 0.2 foot or less at communities on the unprotected side of the WCC (USACE 2012).

A complete description of the numerical and hydrodynamic models used for the LACPR effort, including HSDRRS design, is provided in USACE (2009). Chapter 5 of the Hurricane Isaac Report provides a summary of the modeling used to predict potential increased flooding, as well as a report source list for more information (USACE 2012).

HSDRRS and Hurricane Isaac Performance

On August 29, 2012, Hurricane Isaac made landfall along the Louisiana coastline and affected coastal Louisiana and Mississippi. Hurricane Isaac provided USACE an opportunity to compare a real-time event with the modeled analyses discussed above. During Isaac, the HSDRRS performed as designed in preventing storm surge from inundating areas within the HSDRRS. However, substantial flooding occurred in nearby areas lacking a Federal levee system, such as LaPlace, Slidell, Mandeville, Madisonville, Braithewaite, and Lafitte, Louisiana.

Following Hurricane Isaac, congressional and public concerns were raised regarding the possible effects of the HSDRRS on areas outside of the system. In response to these concerns, the USACE conducted an assessment to answer one primary question, "Did construction of the 100-year HSDRRS have a measurable effect on areas outside the system flooded by Hurricane Isaac?" To determine what impacts, if any, were caused by HSDRRS construction, the USACE conducted an assessment to compare the effects of Hurricane Isaac with the 2012 HSDRRS

system in place and without the 2012 HSDRRS system in place (assuming only the pre-Hurricane Katrina levees, floodwalls, and floodgates in place). The results of the assessment are presented in a Preliminary Report titled *Hurricane Isaac With and Without 2012 100-year HSDRRS Evaluation* which describes the HSDRRS design and associated modeling efforts for design, and summarizes the HSDRRS conditions at the time Hurricane Isaac made landfall. This report also describes the Hurricane Isaac event, evaluates the HSDRRS performance during Hurricane Isaac, compares that performance to a without HSDRRS condition, and provides a summary of the findings (USACE 2012).

Hurricane Isaac was a minimal Category 1 hurricane; however, as a slow-moving storm on a critical track, Isaac moved large amounts of water into low-lying areas of coastal Louisiana. The long duration of tropical force winds, storm track, slow forward motion, storm size, high tide conditions, and significant precipitation combined to create significant storm surge and resulted in flooding coastal areas outside the HSDRRS. In some areas, water levels exceeded those from storms with higher wind speeds such as Hurricanes Katrina and Gustav. Of the 217 miles of levees and floodwalls composing the HSDRRS, high water marks and gage data indicate that the pre-HSDRRS levees and floodwalls would have only been overtopped by surge along approximately 1 percent of the system, and that the old system would have displaced about the same amount of water as the 2012 HSDRRS (USACE 2012). Hurricane Isaac's impacts on areas outside of the Hurricane and Storm Damage Risk Reduction System would have been similar with or without the 100-year system in place. These model results are consistent with the modeling that was conducted prior to starting construction of the HSDRRS.

Water Level Changes in Communities Outside the HSDRRS

A preliminary assessment of water levels within communities outside of the HSDRRS was performed by utilizing provisional measured water stage data, preliminary wind and air pressure data, and the models initially developed as part of the IPET work to examine the system's response to Hurricane Katrina and then applied to the LACPR studies (USACE 2009). A comparison of measured data to model predictions indicates that the model does reasonably well at simulating the effects of Hurricane Isaac across southeast Louisiana and coastal Mississippi. The greatest differences between observed and predicted water levels are in Breton Sound, and the model over-predicts water levels at the upper end of the Caernarvon marsh near Braithwaite by as much as 3 feet (USACE 2012). Specific details on the modeling conducted can be found in the preliminary report.

To determine the impact the HSDRRS had on water levels within and at communities outside the HSDRRS, a sensitivity analysis was conducted. A sensitivity analysis compares results between two model simulations to determine the change caused by a specific parameter or system modification. In this instance, a sensitivity analysis was conducted between the with and without HSDRRS to estimate the change in water levels in communities outside the HSDRRS (Table 1). The sensitivity analysis determined that the differences in water levels between the with HSDRRS condition and the without 2012 HSDRRS condition are generally 0.2 foot or less. The largest increase in water level of 0.8 foot occurs in the immediate vicinity of the WCC (which is an uninhabited area composed of coastal wetlands), but diminishes to a 0.4-foot increase at Crown Point and to a 0.2-foot or less increase at other communities in the area. The combination of the WCC and the increased height of West Bank levees prevented Hurricane Isaac surge waters from overtopping the HSDRRS on the West Bank. The combination of the WCC and higher levees also prevented increased water levels on the unprotected side of the HSDRRS. Water levels were also predicted to have increased by 0.5 foot at the levees on the west bank of Plaquemines Parish just south of Oakville as a result of the Eastern Tie-in (USACE 2012).

**Table 1. Water Level Difference Between the With and Without
2012 HSDRRS**

Location Outside the HSDRRS	Estimated Water Level Change
East Bank Plaquemines Parish	0.0 foot to +0.1 foot
Caernarvon Floodwall	+0.3 foot
Lake Pontchartrain North Shore	-0.1 foot to +0.1 foot
Lake Pontchartrain West Shore	-0.1 foot to +0.1 foot
GIWW WCC Gate	+0.8 foot
Crown Point	+0.4 foot
Jean Lafitte	+0.2 foot
Remainder of Barataria Basin	0.0 foot to +0.1 foot
Orleans Parish	-0.1 foot to +0.1 foot
St. Bernard Parish	-0.1 foot to +0.1 foot
Mississippi Coast	0.0 foot to +0.1 foot

The estimated increase in water levels at Braithwaite were only about 0.1 foot, and the model over-estimates the surge height in this area by nearly 3.0 feet; therefore, this sensitivity analysis likely over estimates the increase in water levels at Braithwaite due to the 2012 HSDRRS (USACE 2012).

The sensitivity analysis estimated that the HSDRRS reduced Hurricane Isaac water levels on the north and south shores of Lake Pontchartrain, as well as in LaPlace and throughout the west shore of Lake Pontchartrain on the order of -0.1 to -0.2 ft. The reduction in water levels in Lake Pontchartrain can be attributed to the construction of the IHNC Surge Barrier and Seabrook Floodgate Complex, which eliminated conveyance of storm surge from Breton Sound to Lake Pontchartrain through the IHNC. Estimated water level increases along the Mississippi Gulf Coast were less than 0.1 foot (USACE 2012).

Summary

The performance of the HSDRRS during Hurricane Isaac met expectations in preventing storm surge from inundating areas within the HSDRRS. However, substantial flooding occurred in areas without Federal levee systems, including LaPlace, Slidell, Mandeville, Madisonville, Braithwaite, and Lafitte, Louisiana. Although Isaac was a Category 1 hurricane, its slow forward motion, large size, track, and high precipitation resulted in significant coastal flooding, and in many locations water levels exceeded those recorded during Hurricanes Katrina and Gustav. Pre-Hurricane Isaac predictions of the effects of HSDRRS on surge outside of the HSDRRS were compared with post-Hurricane Isaac modeled predictions of surge based on data measured during and after Hurricane Isaac to determine how well the model output matches known results (i.e., hindcasting). The comparison indicates that modeled effects of the HSDRRS are consistent with those previously reported during design efforts. Additionally, sensitivity analysis of Hurricane Isaac hindcast for both with and without 2012 HSDRRS conditions estimates only one area (at the WCC) where estimated water level differences exceed 0.4 foot. At the WCC, sensitivity analysis indicates that water level differences were as high as 0.8 foot, but quickly diminish to 0.4 foot and less at communities downstream. For the majority of southeast Louisiana and the Mississippi coast, the estimated differences range from plus to minus 0.1 foot (USACE 2012). For a more in-depth discussion on the modeling utilized in the assessment and detailed discussion of the performance of the HSDRRS in relation to Hurricane Isaac impact please refer to the preliminary report available at <http://www.mvn.usace.army.mil/pao/HurrIsaacwapp.pdf>.

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SECTION 1.0
INTRODUCTION



1.0 INTRODUCTION

The Greater New Orleans Metropolitan Area is located in southeast Louisiana, in an area with historically low topographic elevations, where approximately two-thirds of the area is below mean sea level. In the City of New Orleans, elevations range from +28 feet (ft) to -13 ft mean sea level. Due to the low elevations, southeast Louisiana is highly susceptible to damage from tropical storms. Hurricane Betsy caused substantial damage to the area in 1965. Following Hurricane Betsy, the Lake Pontchartrain and Vicinity (LPV) and the West Bank and Vicinity (WBV) Hurricane Protection Projects were implemented by the United States (U.S.) Army Corps of Engineers (USACE). However, construction was not complete when Hurricanes Katrina and Rita struck the Greater New Orleans Metropolitan Area and much of the Gulf Coast in 2005, causing unprecedented damage. Levees, floodwalls, floodgates, and pump stations in the area were left damaged or destroyed. In accordance with Congressional authorization, the Hurricane and Storm Damage Risk Reduction System (HSDRRS) is designed to provide the New Orleans region with 100-year level of hurricane and storm damage risk reduction (i.e., a level that reduces the risk of hurricane surge and wave-driven flooding that an area experiences to a 1 percent chance each year). The HSDRRS in the Greater New Orleans Metropolitan Area largely encompasses the LPV and the WBV Hurricane Protection Projects. The New Orleans District (CEMVN) is the USACE district charged with implementing the HSDRRS construction effort. However, participation in design and construction involved numerous USACE districts, other Federal agencies, state agencies, and contractors.

This Comprehensive Environmental Document (CED) has been prepared in accordance with the CEMVN National Environmental Policy Act (NEPA) Alternative Arrangements approved by the Council on Environmental Quality (CEQ) (Federal Register Volume 72, Number 48, Tuesday, March 13, 2007) and the CEQ's Regulations (40 Code of Federal Regulations [CFR] §1500-1508), as reflected in the USACE Engineering Regulation (ER) 200-2-2. In light of the emergency nature of the HSDRRS work, the CEQ approved the preparation of the Individual Environmental Reports (IER), IER Addendums, IER Supplementals, and the CED in lieu of traditional Environmental Assessments (EA), or Environmental Impact Statements (EIS) as allowed by CEQ NEPA Regulations (40 CFR §1506.11) in such circumstances. The Alternative Arrangements for the HSDRRS can be found at www.nolaenvironmental.gov, and are also found in appendix A along with the *Federal Register* notice.

The USACE has evaluated and described each proposed project related to the construction of the HSDRRS in an IER. The purpose of the CED is to provide a description of the cumulative impacts of all HSDRRS projects completed in the Greater New Orleans Metropolitan Area in Louisiana, to analyze the indirect cumulative impacts resulting from the HSDRRS projects in combination with proposed and other reasonably foreseeable projects in southeast Louisiana, to describe a mitigation process and specific mitigation measures, to outline future operations and maintenance requirements, and to document coordination and consultation activities and compliance with all applicable environmental laws. The CED integrates the IERs into a single planning document and contains updated information for IERs that had incomplete or unavailable data at the time the CEMVN Commander signed the Decision Record in those instances where that information was available in November 2010. Because HSDRRS planning and construction is occurring concurrently with the preparation of the CED, IERs prepared after November 15, 2010, are not described in this version of the CED. Additionally, any construction work not completed or borrow sites not utilized by July 2011 are not described in this version of the CED. Future supplements to the CED will incorporate HSDRRS planning and construction completed by the USACE after these dates.

The HSDRRS effectively achieved the 100-year level of hurricane and storm damage risk reduction by June 2011. However, construction of the HSDRRS continues; construction will be complete by August 2014. As construction continues, additional IERs and IER Supplementals are being prepared. The CED will be supplemented in the future as needed.

As most of the HSDRRS construction is complete, all HSDRRS work that was listed as proposed and termed “the Proposed Action” in the IERs is described as work that is complete in the CED, and is described as HSDRRS 2011 projects. However, future levee lifts that may be required to meet 100-year risk reduction elevations over the 50-year evaluation period of the HSDRRS (to compensate for changes in elevation due to soil consolidation, subsidence, and sea-level rise) will be discussed as the HSDRRS 2057 work and will be analyzed as reasonably foreseeable work, although at this time, future levee lifts are not authorized. In addition, borrow sites that have not been utilized by July 2011 for the HSDRRS 2011 construction will be classified as proposed sites and, therefore, will be discussed as projects not yet implemented. These borrow sites analyzed in IERs could be used for HSDRRS construction work after July 2011 (USACE 2007d, USACE 2008u, and USACE 2009z). Any use of those borrow sites for work beyond HSDRRS 2011 construction would at a minimum require an evaluation of the relevant authorization, real estate requirements, agency coordination, and environmental and NEPA compliance for any borrow sites analyzed in IERs.

When the NEPA Alternative Arrangements process and the preparation of the CED were outlined in 2007, it was not conceived that design and associated environmental compliance activities or mitigation measures would continue well beyond 2011. Therefore, since the HSDRRS design and construction activities are continuing at the same time this document is being prepared, the cumulative impacts analysis will incorporate information from IER and IER Supplemental documents completed by the date of November 15, 2010, to allow for the CED effort to move forward in a timely manner. IER documents completed after November 15, 2010, and any long-term monitoring and analysis not completed by November 15, 2010, will be described in future supplements to the CED. The supplement(s) to the CED will further build on the cumulative impacts description contained herein and will incorporate all project impacts and mitigation measures.

Although this document discusses other Federal and state programs, it is generally focused on the impacts from construction of the HSDRRS on the human and natural environments of the Greater New Orleans Metropolitan Area. The scope of effort for the CED is the HSDRRS portion of the LPV and the WBV Hurricane Protection Projects, which includes approximately 217 miles of new 100-year level of hurricane and storm damage risk reduction work within the Greater New Orleans Metropolitan Area performed by the USACE and analyzed under the Alternative Arrangements since March 2007. Figure 1-1 illustrates the portion of the HSDRRS project area within Louisiana described by the CED. A list of abbreviations and acronyms used within this document can be found in appendix B.

The USACE implemented the Alternative Arrangements to expeditiously complete environmental analysis for implementation of the HSDRRS, formerly known as the Hurricane Protection System. The HSDRRS was authorized and funded by Congress and the Administration in the 3rd, 4th, 5th, 6th, and 7th Supplemental Appropriations and is described in more detail in section 1.2.2 of this document. The project actions, located within southeast Louisiana, were a part of the Federal effort to rebuild and complete construction of the HSDRRS in the Greater New Orleans Metropolitan Area.

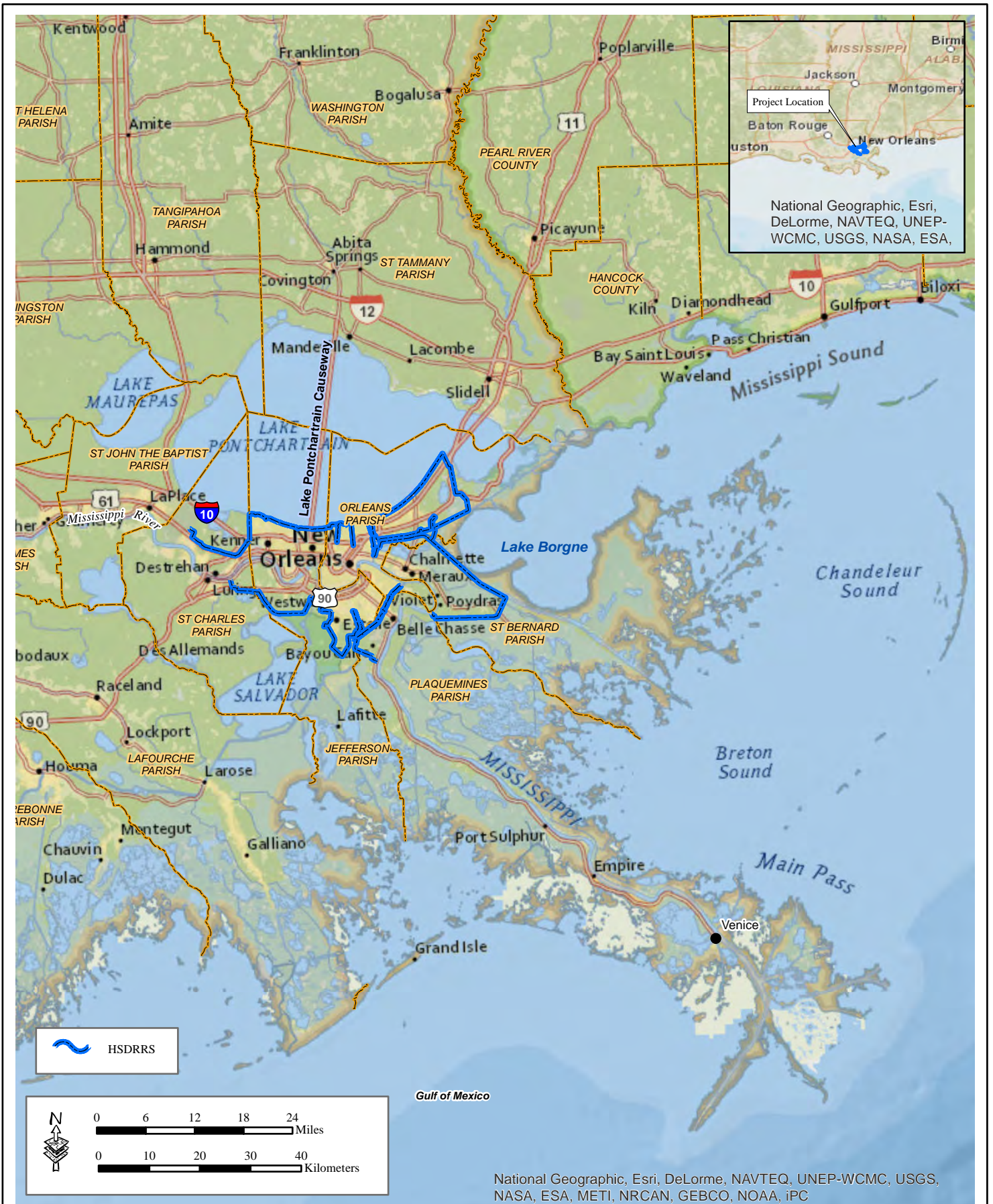


Figure 1-1: Vicinity Map

The USACE set an aggressive construction schedule and originally anticipated that all the HSDRRS construction would be complete by June 2011. However, due in part to the May 2011 Mississippi River flooding, which was at or near the historic flood levels of 1927 and 1937 flooding, the USACE was unable to complete all HSDRRS construction by June 2011. Although the majority of the HSDRRS work is complete, a portion of the HSDRRS was required to have engineering measures put in place to effectively provide and maintain 100-year level of risk reduction at the start of the 2011 hurricane season. After the threat of high water receded, the USACE reinitiated construction, and all construction is anticipated to be complete by August 2014.

The draft CED will be distributed for a 60-day public review period and any comments received during this public review period will be considered part of the official record. Public comments received, along with the USACE responses, will be included as appendix C. After all comments are appropriately addressed, the final CED will be distributed for a 30-day public review period. No sooner than 30 days after the publication of the final CED, the CEMVN Commander will sign the CED Decision Record, which will be made available to the public. All future CED supplements will be made available to the public using this same review schedule.

1.1 SUMMARY OF THE HSDRRS

One of the greatest concerns throughout the Greater New Orleans Metropolitan Area following Hurricanes Katrina and Rita was how to reduce the risk of hurricane, storm, and flood damage for businesses and residences and increase public safety during major storm events. An integrated, comprehensive, and system-based approach to hurricane and storm damage risk reduction was needed to implement the new 100-year level of risk reduction authorized and funded by Congress. The HSDRRS was developed to achieve this goal.

The HSDRRS provides the 100-year level of risk reduction, and includes structural components located on the east and west banks of the Mississippi River within the Greater New Orleans Metropolitan Area. The system of risk reduction structures or components reduces risk in nine separate sub-basins as shown in figure 1-2. The 217-mile integrated system (LPV and WBV components) consists of upgraded levees, floodwalls, closure structures, 56 gates (including sector gates), one surge barrier, 30 stormproofed pump stations, and nine improved or modified drainage structures. These sub-basins also are called polders, and at times during design and construction of the HSDRRS these terms were used interchangeably; however, throughout this document the areas will be called sub-basins. A series of detailed location maps for all of the HSDRRS can be found in appendix D.

The completed HSDRRS will achieve the levels of risk reduction for storm surge and waves that are necessary to meet the National Flood Insurance Program (NFIP). The NFIP is managed by the Federal Emergency Management Agency (FEMA) and contains three main components: flood insurance, floodplain management, and flood hazard mapping. Congress created the NFIP in 1968 to help property owners financially protect themselves against flooding. Through the NFIP, homeowners, renters, and business owners purchase flood insurance if their community participates in the NFIP. In return, communities participating in the NFIP adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. Since the beginning of the NFIP, it was realized that in order to assess and manage flood risk, a national standard was needed. After extensive study and coordination with Federal and state agencies, the 1 percent annual chance exceedance flood (also referred to as the 100-year flood or Base Flood) became the standard for the NFIP and is used to administer floodplain management programs.

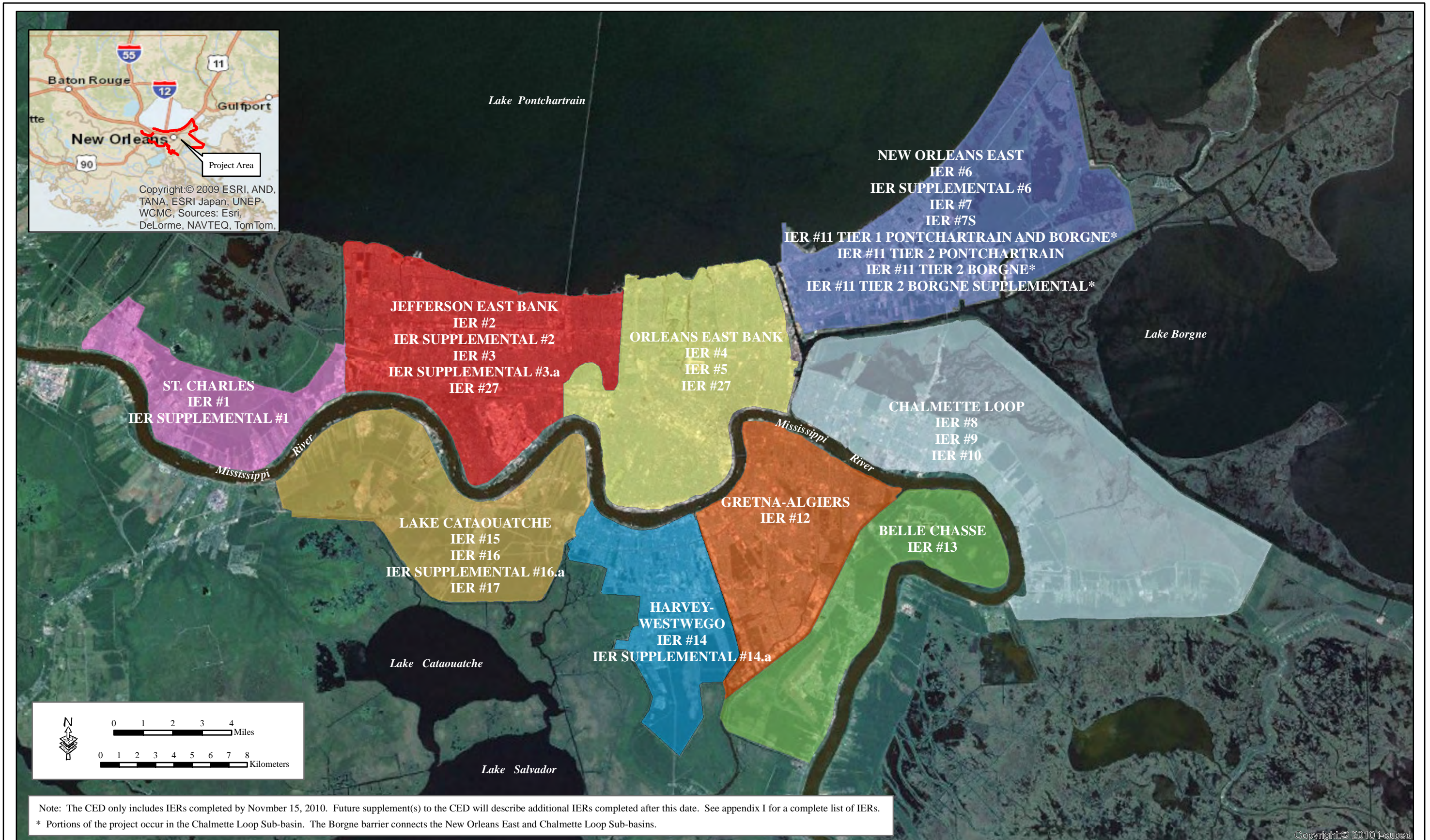


Figure 1-2: LPV- and WBV-Related IERs within the HSDRRS Sub-basins Completed by November 15, 2010

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The 100-year flood standard has been used since the inception of the NFIP and is used for floodplain management purposes for all participating communities for which FEMA has issued flood hazard maps.

As part of NFIP, FEMA develops Flood Insurance Rate Maps (FIRMs) to identify areas that may be subject to flooding. FIRMs guide the determination of flood insurance rates and floodplain management activities. Floodplain maps have been published by FEMA since the beginning of NFIP. In 2003, FEMA embarked on a nationwide program called the Flood Map Modernization (Map Mod) Program, which produced digital flood hazard data and maps known as Digital Flood Insurance Rate Maps (DFIRMs). DFIRMs are more reliable, easier to use, and more readily available than the previous hardcopy FIRMs. As part of the Map Mod Program, FEMA works with Federal, state, and local agencies to ensure that the most up-to-date information is incorporated into the DFIRMs. An accredited levee system is a levee system that has been shown by FEMA to meet the NFIP criteria.

Title 44 CFR 65.10 requires that specific structural requirements be certified by a registered professional engineer or Federal agency, such as the USACE, with responsibility for levee design. The professional engineer or Federal agency must certify that the levee system meets current design, construction, maintenance, and operation standards to provide risk reduction from the 1 percent annual flood, and that the levee meets the NFIP levee system evaluation requirements. The purpose of NFIP levee system evaluation is to determine how flood hazard areas behind levees will be mapped on FIRMs. The resultant maps are then used to determine flood insurance rates, Federal, state, and local floodplain management requirements, and other floodplain management decisions.

NFIP levee system evaluation is a prerequisite for receiving levee accreditation from FEMA. If the levee meets NFIP levee system requirements and is thus accredited, FEMA will not show the area behind the levee as a Special Flood Hazard Area, an area that would be subject to flooding by the 1 percent annual chance exceedance flood. The area instead will be designated as a shaded Zone X, or moderate risk zone. However, even where a levee in place meets the NFIP requirements, flood risk still exists. Flood risk management measures, such as elevating structures, maintaining current warning systems and evacuation plans, and wisely managing floodplain development minimize this residual risk. An area that is subject to inundation by the 1 percent annual chance exceedance flood could be mapped as a high risk, or Special Flood Hazard, area on the FIRM.

The USACE Engineering Circular (EC) 1110-2-6067 provides the consolidated policy for levee system evaluations performed by the USACE for accreditation under the NFIP. The USACE policy document is consistent with and founded on the principles of 44 CFR 65.10. Additionally, the USACE policy document was coordinated with and is supported by FEMA and does not change FEMA's process for mapping or other requirements for the NFIP.

An NFIP levee system evaluation focuses only on the 1 percent annual chance exceedance flood, which is a FEMA flood insurance standard, not a public safety standard. Typically, the NFIP levee system evaluation is the responsibility of the local levee sponsor or community seeking recognition of the levee system on the FIRM. In limited cases, the USACE may perform the NFIP levee system evaluation, which it will do for HSDRRS once construction of the system's critical elements is complete. The USACE generally performs NFIP levee system evaluations for systems it operates and maintains if requested by a non-Federal government entity, such as a county (i.e., parish) or local government, with interest in achieving accreditation with FEMA.

The following outlines the USACE process for performing the NFIP levee system evaluation or supporting the NFIP levee system evaluation for each reach of the HSDRRS:

- (1) A request for NFIP levee system evaluation will be made by the Coastal Protection and Restoration Authority Board of Louisiana (CRPAB), which is the non-Federal sponsor formerly known as CPRA. The CEMVN designates a single point of contact, such as the levee safety officer, and develops standard operating procedures.
- (2) The CEMVN determines the type of system and which authority, if any, applies.
- (3) The CEMVN coordinates with the FEMA Region VI office and the CPRAB to determine the scope of work and schedule for the NFIP levee system evaluation. Scope and cost are based upon availability of data and engineering analyses to be performed.
- (4) The CEMVN determines the applicable funding mechanism.
- (5) The CEMVN performs the technical analysis. The CEMVN develops an investigation strategy and provides a detailed scope of technical studies based on the results of a data and literature search and on-site field inspections. The scope is based on step-wise data collection, which includes design and construction documentation, operations and maintenance inspection procedures and inspection reporting, specific event performance records, and the NFIP levee system evaluation field inspection. The level of detail of the technical analysis is dependent upon the completeness of the technical background data that are available to demonstrate elevation adequacy and structural soundness of the levee system. The CEMVN coordinates with the FEMA Region VI office and the CPRA through the technical analysis process.
- (6) The CEMVN compiles documentation and completes an NFIP Levee System Evaluation Report (NLSER).
- (7) The CEMVN performs the required review of the NLSER.
- (8) The CEMVN coordinates its findings with the FEMA Region VI office, the CPRAB, and the local community and provides a final NLSER to the FEMA Region VI office and the CPRAB.

The USACE has established 10 years as the agency maximum period of validity of certification for levees that are accredited by FEMA in accordance with NFIP levee evaluation requirements. The 10-year validity begins on the date on which the USACE signs and approves the final NLSER. The final approving official for NFIP levee system evaluations in the HSDRRS area is the CEMVN levee safety officer.

The HSDRRS provides 100-year storm damage risk reduction through a variety of structures designed to take into account the height of the 100-year storm surge water level, subsidence, sea-level rise, wave run-up, and associated uncertainties. The HSDRRS does not improve interior forced drainage of excess rainfall within the project area; therefore, the HSDRRS does not provide risk reduction from a 100-year flood event, which has a 1 percent chance of occurring each year at a given location based on rainfall. The 100-year flood event is also influenced by interior drainage, pumping capacities, and river levees and floodwalls.

The following list provides simple definitions for the main risk reduction components utilized in the HSDRRS project.

- Levee – an earthen embankment whose primary purpose is to provide flood risk reduction from high water.
- Floodwall – a man-made, structurally reinforced concrete wall built on top of a levee, or in place of a levee, and designed and constructed to hold back floodwaters.
- Floodgate – a man-made structure that provides access through levees or floodwalls and can include different types of gates, such as swing gate, miter gate, slide gate, horizontal slide gates, overhead slide gate, and fold-up gate.
- Pump Structure – a building and machinery for raising, compressing, or transferring water as part of a forced drainage system. Within southeastern Louisiana, water is pumped from canals located behind the HSDRRS structures into larger waterbodies (e.g., Lake Pontchartrain) or other waterways (e.g., Gulf Intracoastal Waterway [GIWW]) to reduce the potential for flooding.
- Fronting Protection – structures that generally protect pump stations from wave and tidal energy, which can include floodwalls, breakwaters, and closure gates.

All of the sub-basins, except for the New Orleans East sub-basin, are located along the Mississippi River. Flood risk reduction from the Mississippi River is provided by the Mississippi River and Tributaries (MRT) Project, and in the New Orleans area includes the Mississippi River Levee System (MRL). Although the MRT does not meet the 100-year level of risk reduction in all cases, the portions of the MRT within the HSDRRS project area that are susceptible to storm surge were raised to 100-year risk reduction requirements. These MRL and HSDRRS co-located features help to form a closed-loop system. In other words, the HSDRRS project components loop around the entire area without breaks or openings, providing a closed loop of storm risk reduction to residents and businesses within the Greater New Orleans Metropolitan Area.

Within the nine separate sub-basins, the HSDRRS is primarily composed of two large overall risk reduction components, the LPV and the WBV, which divide the main components of the HSDRRS into those located on the east side (i.e., LPV) and on the west side (i.e., WBV) of the Mississippi River. Throughout this document, the terms LPV and WBV will be used when discussing groups of the HSDRRS project components.

The LPV component consists of 126 miles of the HSDRRS structures situated east of the Mississippi River within five sub-basins, as shown in figure 1-2. The LPV project component sub-basins are located in St. Charles, Jefferson, Orleans, St. Bernard, and Plaquemines parishes (all elevations for structures described in the CED are relative to mean sea level in the North American Vertical Datum of 1988 [NAVD 88], unless otherwise indicated).

- St. Charles sub-basin - Levee and floodwall maximum height 18.5 ft
- Jefferson East Bank sub-basin - Levee and floodwall maximum height 17 ft
- Orleans East Bank sub-basin - Levee and floodwall maximum height 21 ft
- New Orleans East sub-basin - Levee and floodwall maximum height 30 ft
- Chalmette Loop sub-basin - Levee and floodwall maximum height 31 ft

Some specific segments, also called reaches, of the LPV component of the HSDRRS include an enlarged levee along the Orleans Parish Lakefront, parallel protection (levees, floodwalls, and flood-proofed bridges) and interim closure structures along three outfall canals (17th Street, Orleans Avenue, and London Avenue), and levees from the New Orleans lakefront to the GIWW. Throughout New Orleans East, the system raised levees, replaced floodwalls, and constructed numerous floodgates at road and railroad crossings. In addition, drainage enhancements and levee reinforcements were constructed to ensure that the system within the LPV project area met 100-year storm design standards. These HSDRRS components are discussed in greater detail in section 2.2 of this document and can be seen in appendix D, Location Maps 1 through 16.

The WBV project components are located on the west bank of the Mississippi River and include portions of Orleans, Jefferson, and Plaquemines parishes. The WBV projects provide approximately 91 miles of structural measures with the construction of levees, floodwalls, floodgates, and a sector gate/pump station complex, which can be seen in appendix D, Location Maps 17 through 23.

The four sub-basins for the HSDRRS WBV projects are (see figure 1-2):

- Belle Chasse sub-basin - Levee and floodwall maximum height 16.5 ft
- Gretna-Algiers sub-basin - Levee and floodwall maximum height 10.5 ft
- Harvey-Westwego sub-basin - Levee and floodwall maximum height 16 ft
- Lake Cataouatche sub-basin - Levee and floodwall maximum height 15.5 ft

The HSDRRS components, such as earthen levees, required a large amount of borrow material (i.e., soils high in clay content) for their construction. In 2007, the USACE began an unprecedented search for suitable material to rebuild and reinforce the HSDRRS in the Greater New Orleans Metropolitan Area. The estimated HSDRRS construction borrow requirement totaled approximately 93 million cubic yards (cy) of material. Borrow sites were located within and outside of the HSDRRS project area and were also evaluated to satisfy the NEPA Alternative Arrangements requirements. The HSDRRS borrow sites are located in 12 parishes in Louisiana, as well as in one county in Mississippi (figure 1-3). Within this document, the HSDRRS risk reduction IERs and borrow IERs are addressed.

The HSDRRS has a period of evaluation of 50 years and has been constructed with the intent that it would be operated and maintained in perpetuity by the CPRAB. All hard structures (e.g., floodwalls and floodgates) were designed to meet the elevations required to accommodate projected sea-level rise and subsidence rates in southeastern Louisiana until 2057. However, earthen levees settle over time as a result of soil conditions and compaction, and design elevations will generally increase over time due to sea-level rise. The USACE determined that additional soils or “lifts” would be required over time to compensate for these soil conditions and other projected variables in order to continue to provide 100-year level of risk reduction for the earthen levee portions of the HSDRRS. The HSDRRS earthen levees were built to the 2011 design elevation to provide the 100-year level of risk reduction, and future levee lifts would be needed to maintain the appropriate elevation relative to changes caused by subsidence and sea-level rise. These anticipated levee lifts are not currently authorized. Although future lifts are not authorized, such lifts are reasonably foreseeable and are described as HSDRRS 2057 construction throughout the CED. The additional borrow material required to raise the HSDRRS levees through a series of levee lifts until 2057, the end of the HSDRRS design life, is currently projected to be approximately 7.3 million cy of borrow.



Note: Locaton maps for borrow sites included in the CED (those with IERs completed by November 15, 2010) are in appendix D

Figure 1-3: Parishes with HSDRRS Borrow Sites Located Inside and Outside of the HSDRRS

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1.2 PURPOSE, NEED, AND AUTHORITY FOR SYSTEM COMPONENTS

1.2.1 Purpose and Need

The purpose of the project is to provide the 1 percent hurricane and storm damage risk reduction for the residents and businesses of the Greater New Orleans Metropolitan Area, as authorized and funded by Congress. The need is to provide increased public safety in the event of future tropical events and to provide for increased public confidence in the ability of the risk reduction system to withstand future storm events. The USACE's highest priority is providing increased public safety through the improvements in the hurricane and storm risk reduction system.

The structural height and design needed to meet the 100-year level of risk reduction was determined using a new, advanced storm-modeling process for estimating hurricane inundation probabilities called the Joint Probability Method with Optimal Sampling (JPM-OS). The JPM-OS frequency analysis determined the 1 percent surge elevations, 1 percent wave heights, and 1 percent wave characteristics for existing conditions, which were then applied in the wave run-up and overtopping calculations. Using this analysis, the USACE was able to estimate wave run-up (additional water elevation due to the impact of waves near shore interacting with individual structures) and determined the elevations required by the HSDRRS to meet overtopping flow rate requirement loads. Additional analysis was then performed to represent the conditions that may occur 50 years in the future (year 2057) as a result of changes in the surge levels and wave characteristics expected due to subsidence and sea-level rise. The results from the JPM-OS were incorporated into the design guidelines for the HSDRRS.

In addition to the JPM-OS modeling, the USACE understood that armoring portions of the HSDRRS earthen levees was critical to provide greater resistance to storm events that exceed the established design level. No design guidance previously existed to provide a rational method for assessing where levee armoring should be placed. Additionally, no methods existed that could estimate the duration of overtopping that can be tolerated before slope damage would occur. A predictive tool based on the erosional equivalence concept was developed by the USACE to simulate the accumulation of excess wave volume for the cases of wave-only overtopping, combined wave and surge overtopping, and time-varying wave and surge conditions. The methodology and critical threshold values were most likely conservative and likely would predict damage sooner than should be expected. However, the methodology provides a useful tool to identify which reaches of the HSDRRS would require additional slope armoring.

1.2.2 Authority

The Congress enacted legislation through a series of Supplemental Appropriation Acts following Hurricanes Katrina and Rita to restore, replace, reinforce, armor, and accelerate completion of the risk reduction system damaged by the storms, and provided additional authority to the USACE to construct new 100-year level of risk reduction HSDRRS project components. Since 2006, there have been seven supplemental appropriations by Congress to provide storm risk reduction to the Greater New Orleans Metropolitan Area. The USACE generally refers to the different authorizations by the term "Supplemental" (such as the 3rd and 4th Supplemental, etc.).

The LPV project was originally authorized under the Flood Control Act of 1965 (Public Law [P L] 89-298, Title II, Section 204), which authorized a "project for hurricane protection on Lake Pontchartrain, Louisiana ... substantially in accordance with the recommendations of the Chief of Engineers in House Document 231, Eighty-ninth Congress." The original statutory authorization for the LPV Project was later amended via subsequent authorizations, including the Water Resources Development Act (WRDA) of 1974 (P L 93-251, Title I, Section 92); 1986 (P L 99-662, Section 401(b)); 1990 (P L 101-640, Section 116); 1992 (P L 102-580, Section 102); 1996 (P L 104-303, Section 325); 1999 (P L 106-53, Section 324); and 2000 (P L 106-541, Section 432).

The Westwego to Harvey Canal Hurricane Protection Project was authorized by WRDA in 1986. The WRDA of 1996 modified the project and added the Lake Cataouatche Project and the East of Harvey Canal Project. The 1999 WRDA (P L 106-53, Section 328) combined the three projects into one project under the current WBV Project name.

Since the 2005 hurricane season, supplemental appropriations were authorized for the HSDRRS work, which enhanced and strengthened the previously existing LPV and WBV projects and included:

- The U.S. Department of Defense (DoD), Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza Act of 2006 (3rd Supplemental - P L 109-148, Chapter 3, Construction, and Flood Control and Coastal Emergencies) authorized accelerated completion of these projects and restoration of project features to design elevations at 100 percent Federal cost.
- The Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery Act of 2006 (4th Supplemental - P L 109-234, Title II, Chapter 3, Construction, and Flood Control and Coastal Emergencies) authorized construction of 100-year level of risk reduction, the replacement or reinforcement of floodwalls, and the construction of levee armoring at critical locations.
- U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Acts of 2007 (P L 110-28, Title IV, Chapter 3, Flood Control and Coastal Emergencies 4302) (5th Supplemental)
- 6th Supplemental (P L 110-252 Title III, Chapter 3, Construction)
- Consolidated Security, Disaster Assistance, and Continuing Appropriations Act of 2009 (P L 110-329), also called the 7th Supplemental.

1.3 Timeline and Summary of Legislation for Flood Risk Reduction and Coastal Restoration in Southeast Louisiana



Flood Control Act of 1917. Enacted to control floods on the Mississippi, Ohio, and Sacramento Rivers in response to 1874 flooding.

Flood Control Act of 1928. Authorized work for basin protection against Mississippi River floods. Later amendments to this Act authorized work to alleviate tributary flood problems.

Flood Control Act of 1962. Authorized the Mississippi River Delta at and below New Orleans flood control project; subsequently known as the New Orleans to Venice Hurricane Protection project.

Water Resources Development Act (WRDA). Amended several sections of various Flood Control Acts to provide that non-Federal public bodies could cost-share infrastructure works.

Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) or "Breau Act" of 1990. The first Federally mandated restoration effort to take place along Louisiana's coast and the first program to provide a stable source of Federal funds dedicated to coastal restoration; also established a task force made up of representatives from the various Federal agencies and the Governor of Louisiana.

WRDA of 1990. Provided for a restudy of and report on the Lake Pontchartrain project benefits or unrealized expected benefits.

EWDA of 1994. Directed the Secretary of the Army to continue the Lake Pontchartrain and Vicinity Hurricane Protection project, including continued construction of parallel protection.

EWDA of 1995. Authorized the Morganza to the Gulf of Mexico feasibility study for the Houma Navigation Canal.

WRDA of 1999. Directed the Secretary of the Army to study the feasibility and necessary construction of a pump adjacent to each of the four proposed drainage structures for the St. Charles Parish portion of the Lake Pontchartrain project and authorized the Secretary to construct the pumps. The Larose to Golden Meadow project, authorized by the Flood Control Act of 1965, is modified to convert the Golden Meadow floodgate into a navigation lock if the Secretary determines it is feasible, environmentally acceptable, and economically justified. In addition, the Secretary is directed to carry out work authorized by part of the Westwego to Harvey Canal project, the East of Harvey Canal project, and the Lake Cataouatche modifications as a single project, to be known as the "WBV, New Orleans, Louisiana, Hurricane Protection project."



1879

Mississippi River Commission (MRC) Act of 1879. Congressional legislation empowered the MRC to prepare plans to improve the river channel, protect the banks, improve navigation, prevent destructive floods, and promote commerce.

1917

1927

Great Mississippi Flood of 1927. Most destructive river flooding in the history of the U.S. The Mississippi River broke free from the levee system in 145 places and flooded 27,000 square miles.

1928

1936

Flood Control Acts continuously enacted for approximately 30 years.

1962

1965

Hurricane Betsy made landfall in Louisiana on September 8, 1965. At landfall in Louisiana, the storm was a strong Category 3. Betsy caused the failure of some levees in New Orleans and caused severe flooding.

Flood Control Act of 1965. Enacted as a response to Hurricane Betsy.

1974

1986

WRDA of 1986. Modified Lake Pontchartrain Hurricane-flood Protection project, authorized by a section of the Flood Control Act of 1965, to construct features, such as floodwalls with sluice gates, so that the level of protection within Jefferson Parish provided by the hurricane-flood protection project would be unimpaired as the result of any pumping station constructed by local interest. Also authorized structural and nonstructural measures to prevent flood damage to areas within the West Bank Hurricane Protection Levee, Jefferson Parish.

1990

1992

WRDA of 1992. Directed the Secretary of the Army to construct measures to intercept and convey drainage from landside slopes to project levees in Jefferson Parish directly to the existing drainage system. Also, the reevaluation of the benefits or unrealized benefits of the constructed portions of St. Bernard Parish levees and to the Lake Borgne Basin Levee District was required.

1994

1995

Energy and Water Development Appropriations Act (EWDA) of 1992. Authorized and directed the Secretary of the Army to provide an entire parallel hurricane protection system along with the raising of levees and improving of flood protection works for the LPV, Louisiana Hurricane Protection project.

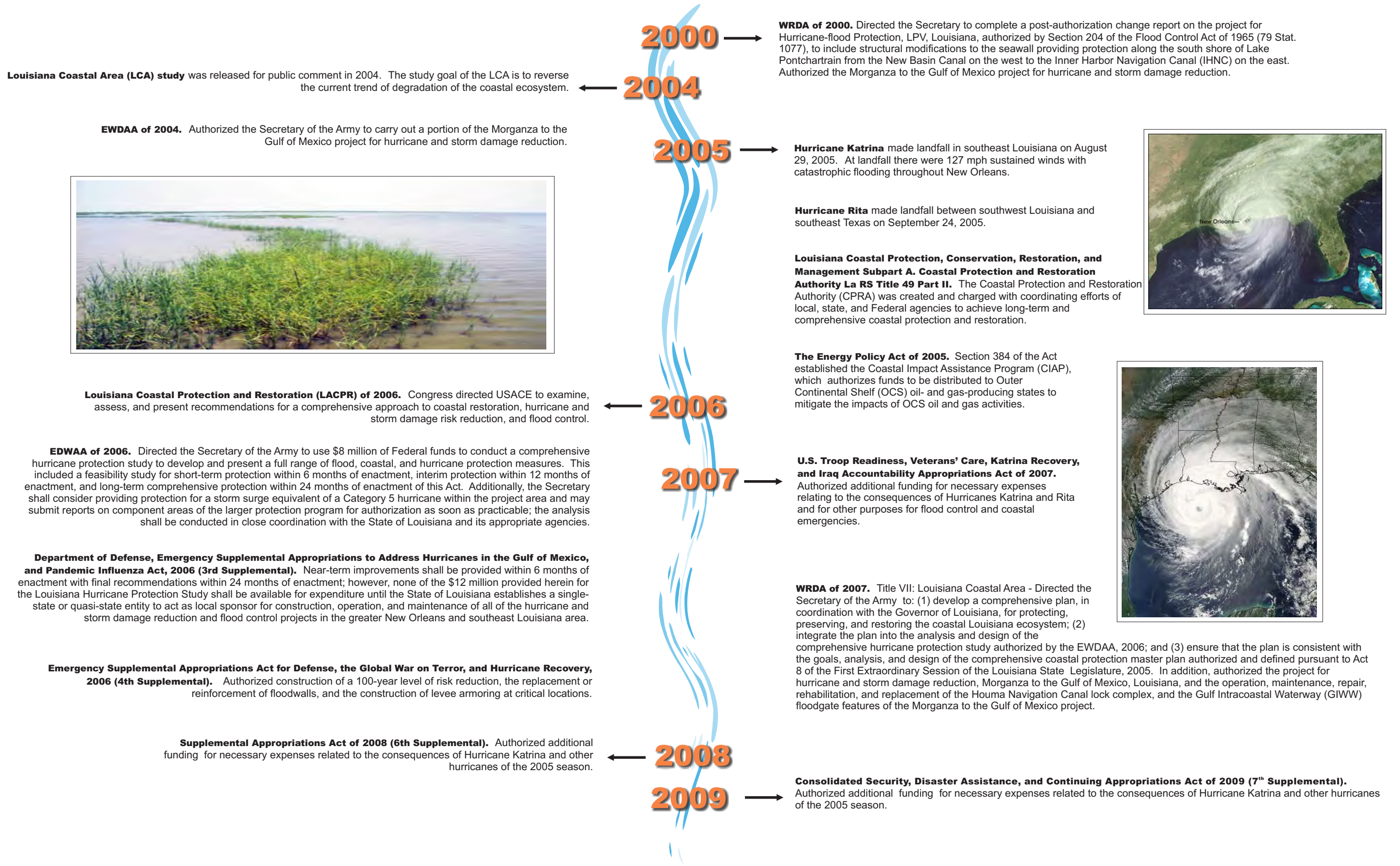
1996

1999

WRDA of 1996. The LPV project for hurricane damage prevention and flood control authorized by the Flood Control Act of 1965 is modified so that St. Bernard Parish and the Lake Borgne Basin Levee District shall not be required to pay the unpaid balance of the non-Federal cost-share. In addition, authorized the project for hurricane damage reduction for the West Bank of the Mississippi River in the vicinity of New Orleans (East of Harvey Canal); West Bank Hurricane Protection (Lake Cataouatche Area), Jefferson Parish. The Act provided for study of storm damage reduction benefits to Grand Isle and vicinity.



1.3 Timeline and Summary of Legislation for Flood Risk Reduction and Coastal Restoration in Southeastern Louisiana (Continued)



1.4 PUBLIC CONCERNS AND PUBLIC INVOLVEMENT

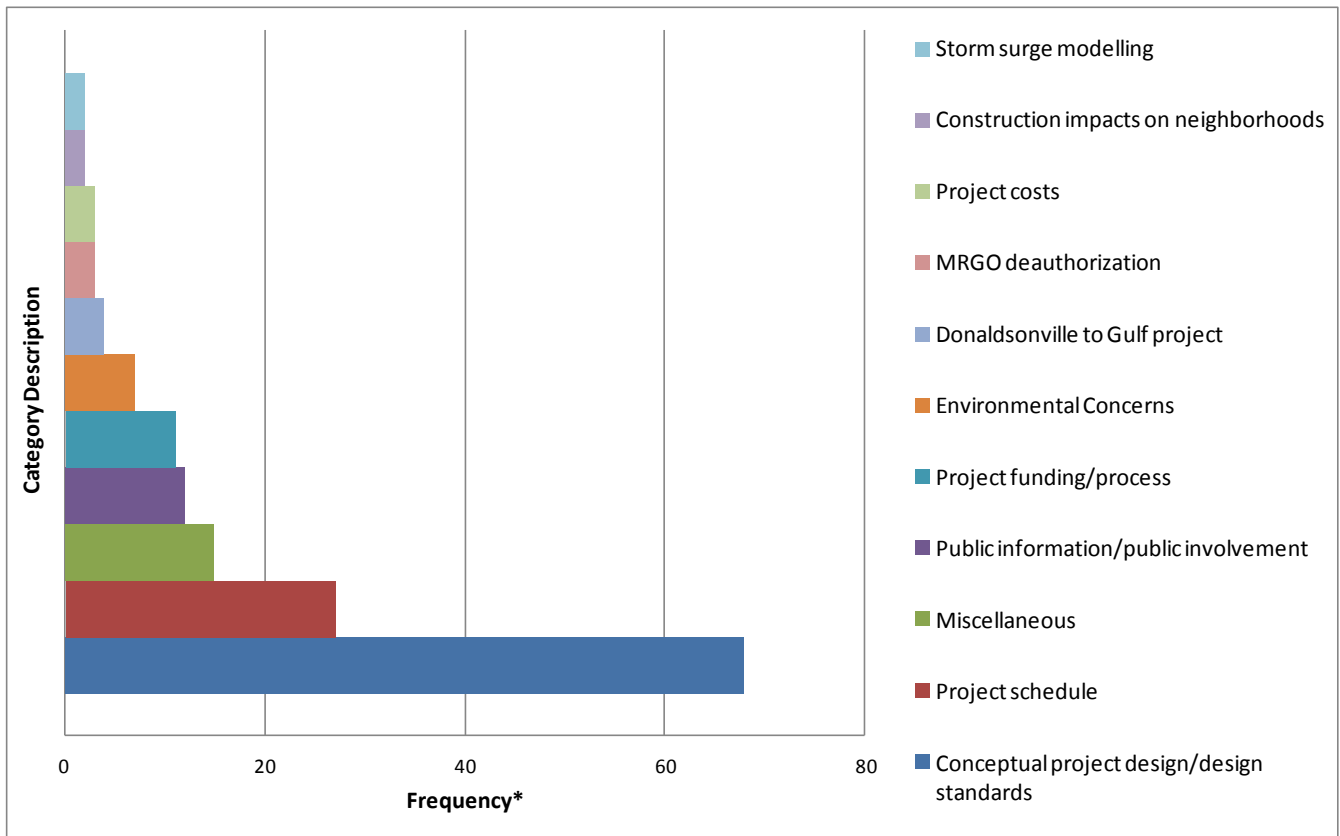
After the devastation of the 2005 hurricane season, the USACE undertook to design and to construct the HSDRRS, as authorized and funded. The HSDRRS is the largest civil works project in the USACE's history, with an estimated cost of \$14 billion. With the development of the HSDRRS came the necessity for public awareness, coordination, and cooperation. A public scoping process was performed by the USACE as an integral part of the NEPA Alternative Arrangement process and as a way to gather information concerning sensitive resources and determine the public's major concerns. This began in early 2007 with nine scoping meetings held between March and April 2007 at various locations within the HSDRRS project area. The public was notified of the NEPA Alternative Arrangement process through the Federal Register on March 13, 2007, a notice in the *USA Today* on March 12, 2007, two public notices in the *Times-Picayune* in March 2007, and 3,700 notices that were mailed directly to the public. A press release for the scoping meetings resulted in several newspaper articles and announcements on local television and radio stations. Additionally, a CED Scoping Meeting was held in September 2009 (see section 1.5 for additional information). Locations of these public scoping meetings can be found in table 1-1. Prior to these meetings, the USACE issued public scoping meeting announcements detailing proposed project segments and IERs, meeting times, and locations. A draft public scoping report and summary of the CED Scoping Meeting can be found in appendix E.

Table 1-1. USACE Public Scoping Meetings

Meeting No.	Meeting Date	Location	Sub-basin and Associated IERs
1	March 27, 2007	Dougie V's Restaurant, Banquet Hall, 13899 River Road, Luling	Lake Cataouatche and Harvey-Westwego; IERs #14, 15, 16, 17
2	March 28, 2007	Westwego City Council Chamber, 419 Avenue A, Westwego	Lake Cataouatche and Harvey-Westwego; IERs #14, 15, 16, 17
3	March 29, 2007	American Legion Hall, Post 366, 12188 River Road, St. Rose	St. Charles; IER #1
4	April 3, 2007	Our Lady of Holy Cross College, 4123 Woodland Drive, New Orleans	Gretna-Algiers; IER #12
5	April 4, 2007	St. Bernard Parish Government Building, 8201 West Judge Perez, Chalmette	St. Bernard; IERs #8, 9, 10, 11
6	April 5, 2007	Jefferson Parish Regional Library, 4747 W. Napoleon Avenue, Metairie	Jefferson East Bank; IERs #2, 3, 5,
7	April 10, 2007	Belle Chasse Auditorium, 8398 Highway 23, Belle Chasse	Belle Chasse; IER #13
8	April 11, 2007	Avalon Hotel & Conference Center, 10100 Interstate (I) 10 Service Road, New Orleans East	Orleans East Bank and New Orleans East; IERs #4, 5, 6, 7, 11
9	April 12, 2007	National WWII Museum, 945 Magazine Street, New Orleans	Orleans East Bank; IERs #4, 5, 11
CED Scoping	September 2, 2009	USACE Office District Assembly Room, 7400 Leake Ave, New Orleans	Comprehensive (All IER and IER Supplemental documents)

Although many people were concerned about specific details of levee heights, structural measures, and pump station locations, the overriding concern was that the risk reduction system be completed as soon as possible. Figure 1-4 shows the frequency of the 11 general categories of concern expressed at the scoping meetings. Some of the main concerns that citizens in New Orleans and southeastern Louisiana described were:

Figure 1-4. Question Categories and Frequency of Questions*



Note: If the same or similar question was asked more than once by an individual, it was only counted once.

*In June 2012, the Donaldsonville, Louisiana to the Gulf of Mexico Feasibility Study was terminated due to low benefit-to-cost ratios for all levee alternatives studied.

- the need for the USACE to provide risk reduction to individual neighborhoods as quickly as possible;
- the need to balance study and action in getting the protection system constructed;
- that another hurricane could again flood the area prior to the 100-year level of risk reduction being completed;
- that construction and operation of pump stations along the lakeshore would impact residents and their neighborhoods;
- that without closing the Mississippi River Gulf Outlet (MRGO), residents of St. Bernard Parish would not be protected from another large storm;
- the need for multiple lines of defense; and whether St. Charles Parish levee projects would be included in the overall protection project or if the USACE would hinder the parish from completing its levee project.

To assist the CEMVN public involvement effort, a website (www.nolaenvironmental.gov) was created in early 2007 to contain and make available all necessary environmental compliance project data. The www.nolaenvironmental.com website includes a Projects tab that provides information and reference material for active projects including HSDRRS IERs, a Meetings tab

that provides a meeting calendar, a searchable Library tab to find relevant documents, a Data Viewer tab for spatial data review, a Get Involved tab that provides contact information and allows users to join email and physical mail lists, and a Related Links tab that has hyperlinks to other relevant USACE and agency websites. The USACE also utilizes the main CEMVN website (www.mvn.usace.army.mil) to provide additional technical information and expertise on the HSDRRS, as well as animated project component videos. Since 2007, there have been over 149 press releases on www.nolaenvironmental.gov regarding the NEPA Alternative Arrangement environmental documents (32 by September 2010, 52 in 2009, 52 in 2008, and 13 in 2007). A calendar on the website allowed individuals to know when public meetings for particular documents were scheduled and when documents were scheduled to be released for public comment. In addition, all the NEPA Alternative Arrangement documents were available for viewing and downloading to aid individuals in participating as a significant part of the planning process for the HSDRRS. On the www.mvn.usace.army.mil website, an electronic newsletter, *Task Force Hope Status Report*, was published twice per month since 2006 highlighting the upcoming HSDRRS efforts. Since March 2006, over 94 of these newsletters (12 by September 2010, 19 in 2009, 20 in 2008, 17 in 2007, and 26 in 2006) have been distributed to the public in public meetings and made available on the internet. There were also videos and animations for many of the HSDRRS projects, which ranged from incorporating non-Federal levees and stormproofing of pump stations, to the Seabrook floodgate alternatives and the IHNC Borgne barrier. Currently there are 17 of these videos and animations. Numerous public meetings (including scoping meetings) (photograph 1-1), workshops, interagency meetings, and partnering meetings were held to discuss various portions of the HSDRRS and other related projects (200 meetings as of December 2011). Numerous meetings have been held for each risk reduction IER, and an average of 35 meetings has been held for each IER. This ranges from only two meetings for IER #27 to 174 meetings for IER #11 (including IER #11 Tier 1 [69 meetings], IER #11 Tier 2 Borgne [54 meetings], and IER #11 Tier 2 Pontchartrain [51 meetings]). A total of 78 public meetings have been held to discuss Borrow IERs.



Photograph 1-1. Example of an HSDRRS informational public meeting.

Since construction of the HSDRRS began, the CEMVN actively kept the public engaged. Several methods were used to do this, including email – with AskTheCorps@usace.army.mil; a telephone number that was monitored 24 hours daily (877-427-0345); the use of social networking sites such as Facebook© and Twitter©; and a site on Flickr®, a photo sharing website that hosts photographs of the ongoing HSDRRS construction work. In addition, the CEMVN used more traditional technology avenues, such as a construction impact telephone hotline that was often passed out on magnetic stickers to residents within the project area.

CEMVN actively listened and responded to the public through the numerous public meetings, public review of IERs, and feedback through electronic media, including the www.nolaenvironmental.com website. Many common concerns by the public have changed through time, indicating success at responding to public concerns and addressing public comments. Comments during meetings at the beginning of the HSDRRS planning process included concerns about adequate available funding for construction, differing start times for

projects leading to perceived unequal risk reduction for residents based on location, interest in how lawsuits could be filed, why some areas flooded while other areas did not, and differing structural elevations based on location in the system. Comments expressed during more recent meetings were focused more on specific project design issues near the location of the meeting, or were concerned about aesthetics, noise, construction traffic, and conditions of borrow sites.

The CEMVN consulted or coordinated with other Federal agencies and state and local agencies, and with Native American Tribes and non-governmental organizations (NGOs). Specifically, the Native American Tribal Nations and NGOs were brought into the coordination and public involvement effort for the HSDRRS through a series of 11 meetings hosted by the CEMVN from April 2008 to March 2011. The NGOs that participated during the development and construction of the HSDRRS include the following organizations:

- American Rivers
- City of Covington Tree Board
- Coalition to Restore Coastal Louisiana
- Coastal Conservation Association
- Ducks Unlimited
- Environmental Defense Fund
- Gulf Restoration Network
- Lake Pontchartrain Basin Foundation (LPBF)
- Louisiana Audubon Council
- Louisiana Bayoukeeper
- Louisiana State University (LSU), Coastal Restoration and Enhancement through Science and Technology Program
- Louisiana Sea Grant
- Louisiana Wildlife Federation
- Make It Right
- National Wildlife Federation
- Nicholls State University
- Orleans Audubon Society
- Sierra Club
- Southern Louisiana Earth Science Research Center Foundation
- The Nature Conservatory
- Tulane University

CEMVN has held specific neighborhood meetings, and met with neighborhood representatives and associations for various HSDRRS components where neighborhood groups expressed concerns. For example, for the 17th Street Canal, Orleans Avenue Canal, and London Avenue Canal pump station complexes, neighborhood meetings were held to review plans and specifications described in the request for proposal for construction contracting. Field trips with stakeholders have been conducted throughout the HSDRRS design and construction, and CEMVN has hosted over 6,500 field trips to show the public all the various components of the HSDRRS.

Additionally, in 2007, the CEMVN archaeologists held two separate meetings with two tribes, the Mississippi Band of Choctaw Indians and the Chitimacha Tribe of Louisiana. Also, a public meeting was held on July 18, 2007, to request comments regarding the Draft Programmatic Agreement for the West Bank and Vicinity and Lake Pontchartrain and Vicinity Hurricane Protection Projects pursuant to Section 106 of the National Historic Preservation Act (NHPA).

Some of the public, NGOs, and others, including Congress, felt that a plan for project design oversight was necessary to ensure that the best possible engineering was being used to design and build the HSDRRS. Within the WRDA of 2007, Section 2035, Congress directed that the

USACE develop a plan to provide for a third-party review of the HSDRRS design and construction activities prior to the initiation of physical construction, and periodically thereafter. In September 2008, the USACE developed the Independent External Peer Review Plan (IEPR) for the HSDRRS with input from the State of Louisiana, the Louisiana Coastal Protection and Restoration Authority (CPRA), the Southeast Louisiana Flood Protection Authority – East, the Southeast Louisiana Flood Protection Authority – West, and the levee districts under the supervision of the Southeast Louisiana Flood Protection Authorities. The IEPR provides compliance with the WRDA review requirement (USACE 2008a).

The first revision to the IEPR was done to eliminate duplicate features and to refocus review to a higher level of unique features; to focus on innovative techniques, design assumptions and changes through project phases (design, construction, operations and maintenance, and monitoring); and add new requirements that deviated from design guidelines. The second revision to the IEPR proposed to evaluate nine unique features/activities and seven system application documents. The IEPR process includes completion of individual reviews, completion of summary reports, approval of the peer review package, and posting for public release by Mississippi Valley Division. An additional unique activity plan was recently added to the list, WBV-14.c.2 New Westwego Pump Station to Orleans Village, for a total of 10 unique features/activities. Some of these features were added at the request of the non-Federal sponsor. The estimated completion date of IEPR for all selected HSDRRS features and products is 2015.

The following are the current IEPR Plan Unique Activities (10):

1. PCCP 01-17th Street Closure and Pumps
2. PCCP 01 - Orleans Avenue Closure and Pumps
3. PCCP 01- London Avenue Closure and Pumps
4. LPV 111.01 New Orleans East Levee CSXRR to Michoud (deep soil mixing only)
5. GIWW WCC
6. LPV 03.2a & 06e.2, I-10 and I-310 Crossing
7. LPV 109.02a – South Point to CSX Railroad
8. LPV 145 – Bayou Bienvenue to Bayou Dupre
9. WBV 14e.2 – V-Line Levee
10. WBV-14.c New Westwego Pump Station to Orleans Village

The following are the current IEPR Plan System Application Documents (7):

1. Design guidelines
2. Armoring manual – R&D
3. Spiral Weld Pipe Study
4. Barge impact Study
5. 1% Design Report
6. 2010 HSDRRS Design Guidelines
7. Harvey & Algiers Canal 100-year Alternative

The following are the steps in the procedure for IEPR Plan process:

1. completion of individual reviews/Final IEPR Report
2. completion of summary reports
3. approval of peer review package
4. posting for public release by Mississippi Valley Division

All approved IEPR Packages will be posted at http://www.mvn.usace.army.mil/pd/pd_peerreview.asp. Three IEPRs have been completed and posted on the website as of January 12, 2012. They are:

- HSDRRS LPV 111.01 - Deep Soil Mixing Design Guidelines
- HSDRRS Design Guidelines: Spiral Welded Pipe Piles for Coastal Structures
- HSDRRS Design Guidelines: Aberrant Barge Impact Loads on Hurricane and Storm Damage Risk Reduction System Floodwalls

Battelle, an independent, non-profit research organization, has selected IEPR panel members using a policy developed by the National Academy of Science to ensure that the reviewers have no conflicts of interest with the projects they are reviewing. The panel participants vary based on the subject review material. Members predominantly come from the engineering and construction industry and are independent experts in their respective disciplines with a minimum of 15 years of experience in their field. The disciplines for the independent experts include civil, geotechnical, structural, hydraulic, and operation and maintenance engineering. Panel members were completely independent of the HSDRRS work being conducted by the USACE (USACE 2008a).

At the end of the review, the USACE will use the information developed by the panel to ensure that the best science and engineering possible were used to complete the HSDRRS. At the conclusion of the review, the USACE will make the panel’s written recommendations and the USACE’s responses available to the public (USACE 2008a).

1.5 CED SCOPING MEETING

During the CED Scoping Meeting held on September 2, 2009, public concerns regarding uncertainties or perceived data gaps were expressed (appendix E). These scoping comments and topics are shown in table 1-2 with the applicable CED section number that contains a resolution discussion.

Table 1-2. CED Scoping Issues and the CED Section Addressing These Issues

CED Public Scoping Comments (Data Gaps or Uncertainties)	USACE Response (includes CED Section Number where discussed)
Economic impact on surrounding communities	section 4.2.15
Environmental Justice – populations most at risk	section 4.2.15
Hazardous, toxic, and radioactive contaminated sediment issues in canals	section 4.2.16
A layman’s explanation of a 1 percent chance of flooding above levee heights	section 1.1, 1.2.1
Safety factor in resiliency	sections 1.2.1 and 2.2.1
Describe how homeowners could exceed 1 percent risk reduction	section 6.1
Interval testing of floodwalls operations	section 8.2
Impact of coastal erosion on 1 percent risk	section 1.2.1, 2.2, and throughout section 4.0
Stormwater, drainage, and infrastructure	section 3.1.9
Incomplete data to be included in IER #12	section 5.3.2.2
Detail of final mitigation plan	section 5.2 (outlines the mitigation process)
Cumulative impacts on regional resources, such as transportation networks, medical, and other regional facilities, and the economy of the area will be more thoroughly discussed in the CED.	sections 4.2.14 and 4.2.15

Table 1-2, continued

CED Public Scoping Comments (Data Gaps or Uncertainties)	USACE Response (includes CED Section Number where discussed)
Total loss of habitat for all IERs is not known	section 5.3.1.7
Cumulative effects on fish and wildlife from all of the WBV and LPV projects will be fully characterized in the CED	sections 4.2.5, 4.2.6, 4.2.7, and 4.2.8

1.6 DATA GAPS AND UNCERTAINTIES

In order to meet the aggressive June 2011 construction timetable, the USACE required that the IERs be as thorough as possible, in order to provide expeditious flood risk reduction to southeastern Louisiana as authorized by Congress. At the time of each IER submission, there were occasionally a few resource categories analyzed in which impacts were not determined, resulting in data gaps in the IER. It was stated in the IERs that the CED would include missing or incomplete resource information. Specific IER data gaps or uncertainties and the CED sections in which they are resolved are listed in table 1-3. However, for data gaps that have not been resolved in the CED, the processes for their resolution have been identified, in most cases.

Table 1-3. Specific IER Data Gaps Addressed but Not Resolved in the CED

IER #	Data Gap	Addressed in CED
<i>Risk Reduction IERs</i>		
1 through 17	Development of final operations and maintenance requirements for all project features	Protocols for the development of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) manuals and water control structure master plans are described in section 8.0
3	National Marine Fisheries Service (NMFS) mitigation plan required.	section 5.3.2.2
7	Monitoring of submerged aquatic vegetation.	section 5.3.2.2
11, Tier 2 Pontchartrain	Monitoring of dissolved oxygen levels and impacts on aquatic resources and fisheries. If the results of monitoring demonstrate the need for additional hydrologic modeling to address impacts, USACE will complete the additional modeling to evaluate alternatives for rectification or mitigation to offset adverse impacts within authorization and funding limits.	section 5.3.2.2 and appendix G
12	Studies for augmenting the Bayou aux Carpes Clean Water Act (CWA) Section 404(c) area to avoid or minimize ecological impacts from the HSDRRS.	section 5.3.2.2 and 5.3.6.1
	Development of an assessment report that addresses potential hydrological and ecological impacts on the Bayou aux Carpes CWA Section 404(c) area (collecting baseline data and developing a long-term monitoring plan).	
<i>Borrow IERs</i>		
18	Borrow pit requires archaeological monitoring	sections 4.2.9 and 5.3.1.14

These data gaps will be addressed in future supplements or phases of the CED. The data gaps from previous IERs are listed below:

- **Socioeconomics and Environmental Justice:** Various IERs had limited discussion of demographic and income data, along with pertinent maps, tables, and photographs. Socioeconomics and environmental justice data satisfying this issue are found in section 4.2.15 of this document.
- **Transportation:** Most IERs were unable to definitively identify access routes to the construction areas. In addition, the USACE performed a Transportation Study, which may not have been available at the time of the final IER submission. The Transportation Report is included in the CED as appendix F. Other transportation information can be found in section 4.2.14 of this document. However, information from completed project construction, such as distance traveled to transport materials during construction, lane and road closures, number of truck trips, and material transport methods, was not collected by contractors and is not available.
- **Mitigation:** All signed IER Decision Records stated that the USACE would provide a final mitigation plan. Mitigation plans are still evolving and, at the time of completion of this CED, the mitigation IERs are not complete. Mitigation information on the process being utilized by the USACE is included in Section 5.2 of this document. Additional information will be included in supplements to the CED upon completion of the mitigation IERs.
- **Cumulative Impacts Analysis:** All signed IER Decision Records stated that the USACE would provide a final comprehensive cumulative impact analysis. The cumulative impact analysis for IERs completed before November 15, 2010, is included in section 4 of the CED.

Some comments received during the September 2, 2009, CED Scoping Meeting were somewhat more generic. Scoping comments were transcribed as expressed in the meeting and are not necessarily phrased in complete sentences. CED scoping comments and the USACE responses to these comments are provided below.

- 1) **CED Scoping Comment:** Environmental Justice relative to timing of activity in specific areas versus other areas.

USACE Response: HSDRRS construction work was approached from the standpoint that all communities within the HSDRRS project area would be provided the 100-year level of risk reduction by June 2011. For each specific HSDRRS reach, certain project execution steps or components were required prior to construction and, at a minimum, include the following: a geotechnical analysis, the design process, an environmental analysis (through execution of an IER), and all necessary real estate transactions. Additionally, all construction contracts were required to go out for a general solicitation period prior to the construction contract being awarded. All of these steps were required to be complete prior to the execution of a construction contract for work on a particular HSDRRS reach. However, each HSDRRS reach had different challenges that may have required increases in schedule time for one or more of these steps, which could have ultimately affected the execution of the construction contract award. In general, it was unknown which, if any, of these steps would have caused potential delays in the project execution of an HSDRRS Proposed Action and, ultimately, the construction of that action. Therefore, timing of construction activities was the result of collective duration that was required to complete the preconstruction planning activities, contract design, and award. Contract awards as of October 12, 2011, are summarized in appendix H.

- 2) CED Scoping Comment: Public safety during construction and legacy issues with borrow pits.

USACE Response: Safety at borrow sites was addressed by the construction contractor through adhering to an Accident Prevention Plan established as part of the construction contract. Safety on roads near the borrow sites was influenced by local police enforcement and other safety strategy measures. Part of the attempt to reduce safety risk involved informing the public about nearby borrow sites and construction truck traffic. As part of this public awareness strategy, the USACE Traffic Team gathered weekly construction activity reports and prepared a brief summary of the activities for each HSDRRS borrow and construction project. Reports were posted on the USACE website, www.mvn.usace.army.mil, under a link titled “Red Truck.” The Red Truck was a screen icon link of a red dump truck that, when selected, opened information about current individual HSDRRS construction activities. Additionally, the USACE Traffic Team and Louisiana Department of Transportation and Development (LADOTD) cooperated by placing links to each other’s informational websites. Approval for most project plans included agreement about the roads that would be used or modified to deliver materials to the project site. Modifications were generally limited to minor lane and intersection revisions. When right-of-way (ROW) was readily available, turn lanes, deceleration lanes and acceleration lanes were added to improve truck movements. Also, pavement markings and signs were revised for clarity and informational purposes.

Government-furnished borrow sites, such as the Bonnet Carré Spillway, would follow to the greatest extent practicable the design guidelines found in USACE *Part V of Environmental Design Considerations for Main Stem Levee Borrow Areas along the Lower Mississippi River, Lower Mississippi River Environmental Program, Report 4* (April 1986), herein referred to as Report 4. Several Borrow IERs describe that USACE-directed landscaping would occur at borrow sites; however, landscaping was not implemented at contractor-furnished borrow sites because the USACE does not have the authority to demand that private landowners landscape their property following borrow material excavation. The pre-approved contractor-furnished borrow sites are privately owned and, although borrow from some of the contractor-furnished sites was utilized by contractors for the USACE, the Federal government had no authority to require the owners of such sites to reuse their borrow site in a particular manner or to fence a contractor-furnished borrow site. Some Parish ordinances (e.g., Jefferson Parish; Jefferson Parish 2009) establish construction design and post-construction use criteria and borrow sites within these parishes should have complied with such ordinances. The majority of borrow sites evaluated have not been used for HSDRRS construction as of July 2011.

- 3) CED Scoping Comment: Insurance coverage in region and relation to the NFIP requirements.

USACE Response: The HSDRRS provides 100-year level of hurricane and storm damage risk reduction for the Greater New Orleans Metropolitan Area and is designed to withstand surge levels and waves that have a 1 percent chance of occurring each year. The goal is to meet the NFIP requirements in the perimeter risk reduction provided by the HSDRRS. However, FEMA administers the NFIP. More discussion on this can be found in sections 1.1 and 8.0.

- 4) CED Scoping Comment: Impact of global warming > 50 years.

USACE Response: The USACE utilized an advanced storm-modeling process to estimate hurricane inundation probabilities in which predicted sea-level rise and

Louisiana subsidence data were factored into the modeling process as discussed in section 1.2.1. Additionally, the HSDRRS was designed for a period of evaluation of 50 years, and variables such as global sea-level rise and subsidence rates within southeast Louisiana were factored into the design life of the system. Hardened structures (i.e., floodwalls, floodgates) were built to the predicted 2057 design elevations; however, levees were built to the 2011 design elevations, and future lifts if funded and authorized will be needed to continue to provide the 100-year level of risk reduction through 2057. Resources affected by climate change that were not specifically covered in the IERs are discussed further in section 4.0.

5) CED Scoping Comment: Induced development – conservation easements.

USACE Response: Induced development and the use of conservation easements were issues raised by U.S. Fish and Wildlife Service (USFWS) with the IER #16 project work. The USACE determined that USFWS recommendations that non-development easements be acquired for enclosed wetlands would not be adopted. The USACE policy on induced development is that land development is subject to state and local land use rules, including permit and zoning requirements. Therefore, state and local entities are responsible for determining whether mitigation for development is appropriate. This is strengthened by a study that USACE performed in 1994 to help develop policy guidance on mitigation for induced development as a result of potential indirect impacts from the Westwego to Harvey Canal Hurricane Protection Project. The results of this study and subsequent policy set in May 1995 determined that:

“...Indirect impacts such as land development are subject to compliance with local and state permit and zoning requirements, and therefore local and state interests are responsible for defining the appropriate mitigation requirements for land development activities. The direct causative agents of indirect impacts and the beneficiaries are the developers themselves. It is not equitable to allow state and local governments to avoid assuming responsibility for managing development and resources by placing the burden of local environmental protection on the national taxpayer.”

Additionally, the USACE concluded that induced development in the Westwego to Harvey Canal area since 1995 has not been realized. Therefore, any future induced development that might have occurred through the implementation of the HSDRRS was difficult and perhaps even impossible to predict.

6) CED Scoping Comment: Federal highway impacts such as truck traffic quantification for local streets and the impacts of the HSDRRS truck traffic on humans, as well as environment/street repairs impacts.

USACE Response: Quantification of local street truck traffic has not been performed although the USACE had a Traffic Management Team track the traffic impacts that likely occurred from the construction of the HSDRRS (see 4.2.14.5). See also the response to Comment 2 regarding the “Red Truck” application on the USACE website.

7) CED Scoping Comment: Improvements and how they fit into neighborhood planning vision via neighborhood associations.

USACE Response: A series of scoping meetings for the HSDRRS and the CED, as well as numerous presentations and workshops, allowed the public to voice their concerns with the HSDRRS improvements within their neighborhoods. The USACE examined the public comments from these meetings and, if modification to the HSDRRS project work

was feasible and cost effective to minimize negative effects or address public concerns, then the USACE IER actions were changed. This included reducing the project footprint by replacing levees with floodwalls and reducing impacts by proposing mitigation measures. Further, comments received by neighborhood associations and other local groups during the 30-day public review of each IER were evaluated and used to make specific design changes or to incorporate mitigation measures to reduce impacts on land uses in neighborhoods.

- 8) CED Scoping Comment: Local government compensation regarding mitigation impacts.

USACE Response: Federal, state, and local roadways are designed for specific levels of service, and in many cases the HSDRRS did not affect these levels of service, or the levels of service returned to pre-construction conditions once the HSDRRS construction activities were complete. However, local roads and bridges were likely impacted by the HSDRRS construction. Except for very specific locations damaged during construction, at this time, the USACE does not anticipate that any compensation or mitigation for roads within the HSDRRS project area would be provided. However, other Federal, state, and local government entities could rehabilitate and repair roadways dependent on other funding besides HSDRRS funding.

- 9) CED Scoping Comment: Public involvement in CED and public review periods.

USACE Response: See the USACE response to CED Scoping Comment #7 and sections 1.4 and 6.1 of this document.

1.7 PROPOSED ACTION SELECTION RATIONALE

Since the inception of the NEPA Alternative Arrangement process, the USACE's intent was to employ an integrated, comprehensive, and systems-based approach to hurricane and storm damage reduction in raising the HSDRRS to the 100-year level of risk reduction. Although designed and constructed as a system, each HSDRRS IER had its range of alternative actions. This approach allowed for decisions to be made based on unique location and circumstances and discrete construction components. The alternatives analysis and selection process remained integrated and comprehensive, considering alignment areas in relation to one another and other past, current, and reasonably foreseeable actions by the USACE and other entities within the component project area. Additionally, other alternatives were formulated to address reach-specific opportunities and constraints, all of which were described in detail in each IER.

The NEPA requires that a Federal agency consider an alternative of "No Action" in addition to the proposed action and other reasonable alternatives. Also, Section 73 of the WRDA of 1974 (P L 93-251) requires the USACE to give consideration to non-structural measures to reduce or prevent flood damage. The USACE Project Delivery Team (PDT) considered both a No Action alternative and non-structural measures in the IER for each reach of the system. In addition to the alternatives mandated by the NEPA and WRDA, a range of reasonable "action" alternatives that met the project's purpose and need were formulated through input by the USACE PDT, Value Engineering Team, engineering and design consultants, affected local governments, the public, and resource agencies for specific HSDRRS alignments described in each IER. Typically, the "action" alternatives were composed of alternative alignments for that flood risk reduction location. Scales of effect were considered to evaluate various flood risk reduction design alternatives that could be utilized within a given alignment. The alternatives were evaluated for cost effectiveness, engineering effectiveness, environmental protection, and social acceptability.

Once a full range of alternatives was established for each reach, the USACE used the Alternatives Evaluation Process (AEP), a systematic process for recommending a Proposed Action alternative (USACE 2008f). Those alternatives that did not adequately meet these criteria were considered infeasible and were eliminated from further study (USACE 2008f). Through the AEP, various factors were evaluated and weighted to determine the preferred alternative. These factors were:

- Risk/Reliability – level of risk vs. how reliable the component would be at fulfilling its function.
- Schedule – such as construction duration and real estate acquisition duration.
- Cost – overall cost of alternative component construction.
- Natural Environmental Impacts – such as wetlands impacted, impediment to animal passage, and impact on nesting.
- Human Environment – such as the number of homes/businesses impacted, impediment to water access, and miscellaneous (e.g., pile driving vibrations).
- Operation and Maintenance Impacts – cost and relative ease of operations and maintenance (USACE 2008f).

After a particular AEP-recommended alternative plan was chosen, the CEMVN Commander was briefed on this plan for each proposed action. The CEMVN Commander then made a decision if this particular AEP-recommended alternative would proceed for a NEPA Alternative Arrangements analysis in an IER or if the PDT would continue to investigate other alternatives. Additionally, a review of construction processes to identify obstacles was performed. When the review found that a particular recommended alternative was able to be constructed in a sound and timely manner, then that alternative became the Proposed Action for that particular IER. At times, the review indicated that a particular recommended alternative could not be effectively constructed due to various reasons. For instance, IER #9's original AEP-recommended alternative (Alternative 1) was determined to be too close to Elevating Boats, LLC (EBI), and to several residences and, therefore, contained obstacles to construction. Based on additional investigations and evaluation by the design team, a different alternative became the Proposed Action for the IER in question.

At other times, an IER Supplemental was prepared to document a change in the Proposed Action if a Decision Record had been previously signed for the action. Prior to November 15, 2010, a total of eight IER Supplementals have been prepared as a result of project changes occurring after the Decision Record had been signed.

SECTION 2.0
DESCRIPTION OF THE HSDRRS AND IERS



2.0 DESCRIPTION OF THE HSDRRS AND IERS

The HSDRRS is composed of components located on the east (LPV projects) and west (WBV projects) banks of the Mississippi River in the Greater New Orleans Metropolitan Area. The HSDRRS components and structures provide reduced risk to nine separate sub-basins (see figure 1-2) and consist of approximately 217 miles of levees, floodwalls, closure structures, and pump structures.

A total of 17 IERs were initially prepared to describe the specific structural components of the HSDRRS. However, additional IERs were added, along with various IER Supplemental documents assessing design changes encountered prior to and during construction. Two IER documents (and IER Supplemental documents) were tiered from a broader initial design IER (IERs #11 Tier 1 and 2 Pontchartrain and Borgne). The HSDRRS also required a substantial amount of borrow material for use in levee construction. All of the proposed borrow areas were also described and analyzed in IERs. As of November 15, 2010, which has been determined to be the cutoff date for incorporation of information from IERs into the CED (future supplement(s) to the CED will address IERs prepared after November 15, 2010), 11 borrow IERs were prepared to meet the requirements of the NEPA Alternative Arrangements (appendix I). The HSDRRS IER project locations are shown in figure 2-1 and encompass the outermost edge of the nine HSDRRS sub-basins. More detailed maps of the IER HSDRRS project alignments and actions can be found in the location maps in appendix D.

Impacts on wetlands and non-jurisdictional BLH required mitigation by the USACE to reduce the level of impacts and ensure no net loss of wetland functions. Two mitigation IERs are being prepared to describe the compensatory mitigation process, including location, implementation, maintenance, and monitoring of mitigation activities, and are discussed in section 2.4.

In some cases, after an IER became final and a Decision Record was signed, conditions changed surrounding the HSDRRS action, and it was necessary to supplement the IER to accommodate these changes and address any previously unconsidered impacts. This analysis was done in an IER Supplemental. After the USACE moved into the contracting and construction phase of the HSDRRS, some small changes were potentially needed to expedite or enhance the construction effort. These changes did not rise to the level of analysis that required an IER Supplemental evaluation, but still required a minimal environmental review to ensure that impacts previously addressed were not altered. The USACE accomplished this environmental review through the implementation of environmental reevaluations. In these environmental reevaluations, the USACE ensured that all applicable regulations were followed and any coordination or consultation required with other agencies was accomplished. Additionally, all environmental reevaluations were presented to an interagency team of Federal and state agencies (appendix J). In many cases, the environmental reevaluations were necessary to address such things as changes within ROW (utility crossings, revised staging areas) or installation of ramps or fences during construction activities. A table listing the IER reevaluations signed by the USACE and any additional agency consultation/coordination required is included in appendix K. As of November 2010, there were 20 environmental reevaluations of various IERs, including IERs #1, #4, #6, #7, #9, #10, #11 Tier 2 Pontchartrain, #12, #13, #14, #15, #16, and #22.

All IERs with Decision Records signed by November 15, 2010, including Supplementals and addendums, are incorporated into the CED by reference and, while potentially noted in portions of the CED for clarity, they are not further cited within the text of this document (USACE 2008b, c, g-i, k, l, o, p, r-t; 2009a-l, n, q, s, v-x; 2010b, c, e, g-k). Although draft IERs (or IER Supplemental documents) may be referenced in graphs, figures, or maps, if the Decision Record for an IER or IER Supplemental was not signed by November 15, 2010, the impacts on the human and natural environment described by the documents were not analyzed in this version of the CED.

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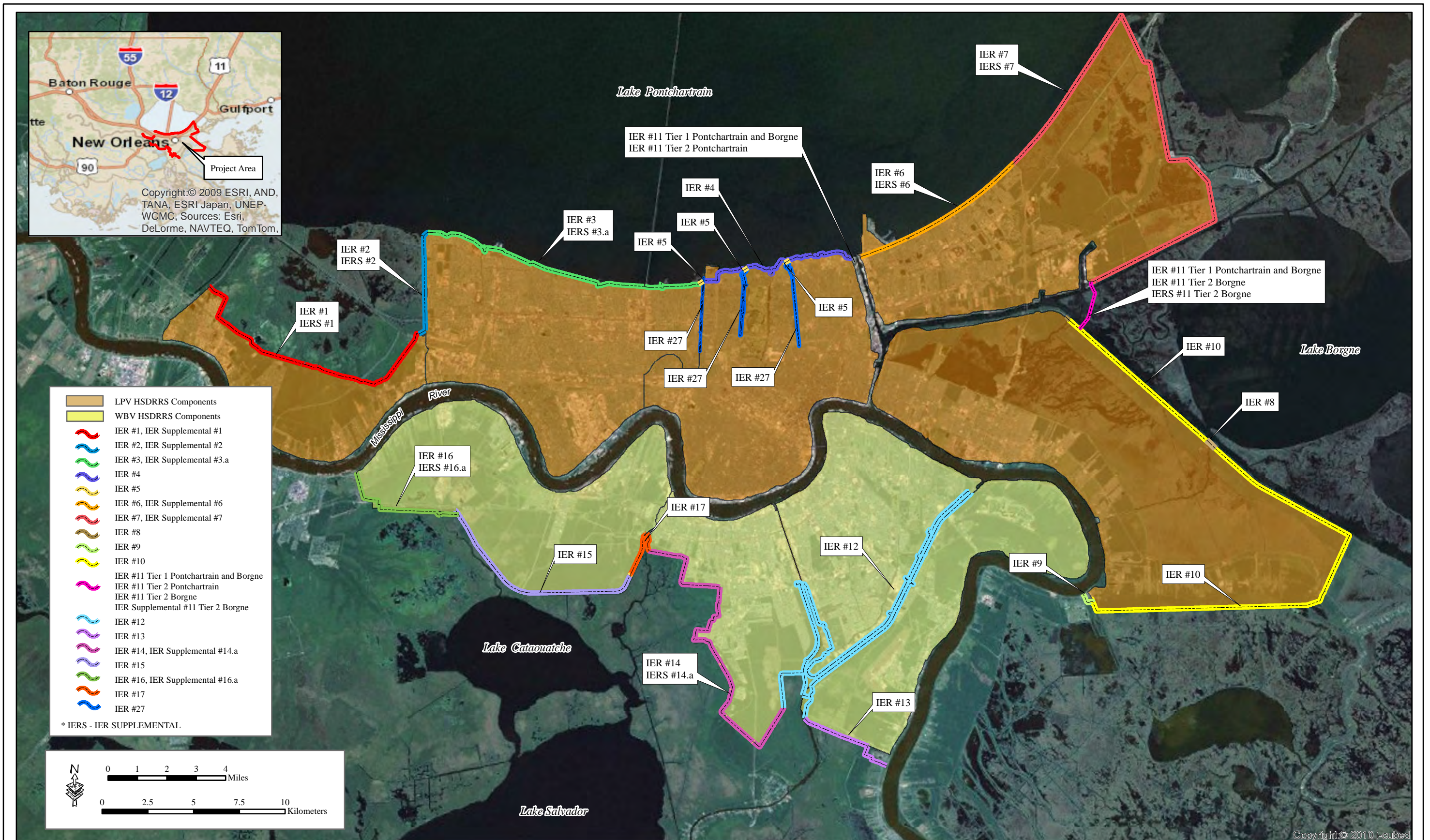


Figure 2-1: The HSDRRS LPV and WBV IER Projects

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The IERs and IER Supplemental documents not analyzed in this version of the CED will be included in subsequent versions or phases of the CED at a later time. Those IERs and IER Supplemental documents not analyzed in the CED include the following:

- IER Supplemental #1b (Risk Reduction)
- IER Supplemental #2.b (Risk Reduction)
- IER Supplemental #5 (Risk Reduction)
- IER Supplemental # 10 (Risk Reduction)
- IER Supplemental #11.b Tier 2 Borgne (Risk Reduction)
- IER Supplemental #11.c Tier 2 Borgne (Risk Reduction)
- IER Supplemental #11.d Tier 2 Pontchartrain (Risk Reduction)
- IER Supplemental #12 (Risk Reduction)
- IER Supplemental #12.a (Risk Reduction)
- IER Supplemental #12/13 (Risk Reduction)
- IER Supplemental #13a (Risk Reduction)
- IER Supplemental #15.a (Risk Reduction)
- IER Supplemental #15.b (Risk Reduction)
- IER Supplemental #16.b (Risk Reduction)
- IER Supplemental #25.a (Borrow)
- IER Supplemental #27.a (Risk Reduction)
- IER #33 (Risk Reduction)
- IER Supplemental #33.a (Risk Reduction)
- IER Supplemental #25.a (Borrow)
- IER #35 (Borrow)
- IER #36 (Mitigation)
- IER #37 (Mitigation)

A more detailed listing of the IERs and IER Supplemental documents analyzed and included in the CED and those not analyzed in this version of the CED can be found in tables within appendix I. These tables also provide information on when these IER and IER Supplemental Decision Records were signed by the CEMVN Commander.

2.1 HSDRRS PROGRAMMATIC DEVELOPMENT OF ALTERNATIVES

Alternatives were developed for each reach or component segment of the HSDRRS. Reaches were identified by a project identification number that included the historic project component descriptor (LPV or WBV) and a numerical descriptor. All reasonable action alternatives were evaluated for each reach (i.e., LPV-106) and for entire alignments within each sub-basin (i.e., Chalmette Loop), and a No Action alternative for each reach was considered. Additionally, non-structural measures were evaluated as required by Section 73 of the WRDA of 1974. This reach-based analysis allowed the USACE to make decisions in a manner cognizant of local circumstances. It also took into account the relationship between reaches and other current and reasonably foreseeable actions by the USACE and other entities within the HSDRRS project area. The following standard set of alignment alternatives and alternative scales within the alignment were considered for each reach:

Alternative Alignments:

- Existing alignment
- Flood-side shift (all toe-to-toe construction occurs on flood side of existing levee or floodwall)
- Protected-side shift (all toe-to-toe construction occurs on protected side of existing levee or floodwall)

Alternative Scales:

- Earthen levee
- T-wall type floodwall (figure 2-2)
- Modified T-wall straddling existing I-wall
- Earthen levee with T-wall cap
- Earthen levee using deep soil mixing

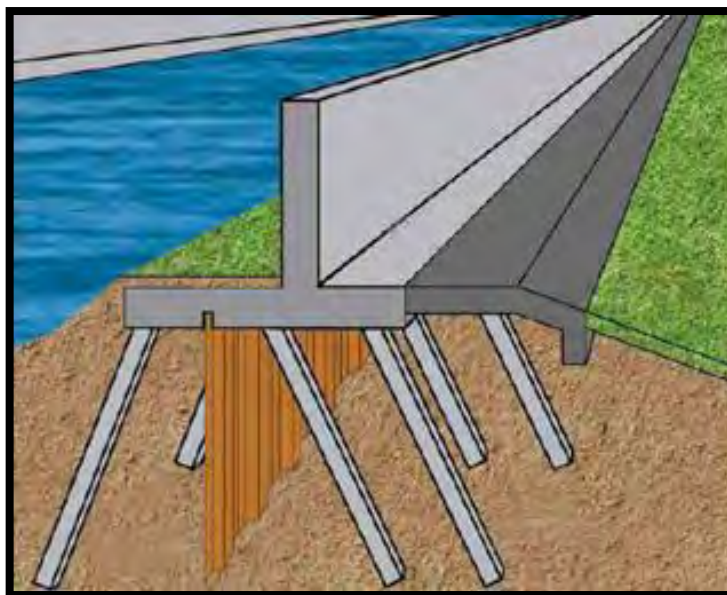


Figure 2-2. T-wall Schematic Example

2.1.1 Description of No Action Alternative

CEQ's regulations and the USACE's ER 200-2-2 for implementing NEPA require that a No Action alternative be evaluated. Under the No Action alternative, the HSDRRS would be rebuilt to the previously authorized elevations utilizing current design criteria (as authorized under the Flood Control Act of 1965, P L 89-288, Title II, Section 204) rather than to the 100-year level of risk reduction. Maintenance of all existing components and structures would continue unchanged. The level of hurricane and storm damage risk reduction provided by the No Action alternative would not be changed in the Greater New Orleans Metropolitan Area, which includes St. Charles, Jefferson, Orleans, St. Bernard, and Plaquemines parishes. Although the No Action alternative was not implemented for any reach within the HSDRRS, the impacts from implementing the No Action alternative for the HSDRRS were described in each IER to provide a baseline for comparison of impacts on significant resources, and helped determine if the Federal action should go forward. Similarly, a No Action alternative for the HSDRRS borrow sites was evaluated in the IERs for each borrow site.

2.2 HSDRRS COMPONENTS

2.2.1 Description of LPV-related IERs

The LPV portion of the HSDRRS was addressed in 12 IERs and four IER Supplemental documents, which evaluated project features providing 100-year level of risk reduction for New Orleans and the surrounding east bank parishes. Projects consist of earthen levees, new T-wall floodwalls, roadway and railroad floodgates, sector gates, pump structures, and elevation of highway and roadway ramps. LPV projects provide greater than 126 miles of risk reduction

improvements, with approximately 43 miles of improvements directly along the northern shore of Lake Pontchartrain (see figure 1-2).

Hardened structures were built with elevations to provide the 100-year level of risk reduction through 2057. Because those structures cannot easily be upgraded in the future, if required due to subsidence and sea-level rise, and would be very difficult to rebuild if damaged, the final elevations for such structures include an additional 2 ft of structural superiority. Levees were built to provide the 100-year level of risk reduction at the 2011 elevation. Future levee lifts would be required to continue to provide the 100-year level of risk reduction through 2057. If authorized and funded, these levee lifts would occur when the elevations of levees are no longer adequate to provide the 100-year level of risk reduction due to elevation changes related to subsidence and sea-level rise.

Table 2-1 lists the IERs prepared describing HSDRRS projects from the western tie-in to the Bonnet Carré spillway floodwall to the eastern tie-in to the MRL at the Caernarvon Canal.

Table 2-1. LPV Projects Included in the HSDRRS

IER* #	Sub-basins	Parish	Short Title	Decision Record Date
1/S 1	St. Charles	St. Charles	La Branche Wetlands Levee	June 9, 2008/June 29, 2009
2/S 2	Jefferson East Bank	St. Charles, Jefferson	West Return Floodwall	July 18, 2008/ October 29, 2009
3/S 3.a	Jefferson East Bank	Jefferson	Lakefront Levee	July 25, 2008/ December 18, 2009
4	Orleans East Bank	Orleans	New Orleans Lakefront Levee, West of Inner Harbor Navigational Canal	March 13, 2009
5	Jefferson East Bank and Orleans East Bank	Orleans, Jefferson	Outfall Canal Closure Structures, 17 th Street Canal, Orleans Avenue Canal and London Avenue Canal	June 30, 2009
27	Jefferson East Bank and Orleans East Bank	Orleans, Jefferson	Outfall Canal Remediation on the 17 th Street, Orleans Avenue, and London Avenue Canals	October 7, 2010
11 Tier 1 Pontchartrain/ 11 Tier 2 Pontchartrain	New Orleans East	Orleans	Inner Harbor Navigation Canal Navigable Floodgates, Tier 2 Lake Pontchartrain	March 14, 2008/ April 1, 2010
6/S 6	New Orleans East	Orleans	Citrus Lakefront Levee	June 25, 2009/ February 8, 2010
7/S 7	New Orleans East	Orleans	New Orleans East Lakefront to Michoud Canal	June 19, 2009/May 3, 2010
11 Tier 1 Borgne/11 Tier 2 Borgne/S 11 Tier 2 Borgne	New Orleans East ¹	Orleans, St. Bernard	Improved Protection on the Inner Harbor Navigation Canal	March 14, 2008/October 21, 2008/ December 10, 2009
8	Chalmette Loop	St. Bernard	Bayou Dupre Control Structure	June 23, 2009
10	Chalmette Loop	St. Bernard	Chalmette Loop Levee	May 26, 2009
9	Chalmette Loop	St. Bernard	Caernarvon Floodwall	February 8, 2010

*S – Supplemental

¹The project described by IER 11 Tier 2 Borgne ties together the New Orleans East and Chalmette Loop Sub-basins. The majority of the construction footprint occurs outside of the boundaries of both sub-basins, and creates a surge barrier for the IHNC/MRGO. However, the project description and environmental consequences of its construction are described in the New Orleans East Sub-basin, as many of the previously completed studies associated with changes in hydrology and hydrodynamics, and fish passage into Lake Pontchartrain evaluate both the Borgne barrier and Seabrook gate complex.

Table 2-2 provides a summary of the HSDRRS project reaches that compose the HSDRRS LPV components. Projects included are from the western tie-in to the Bonnet Carré Spillway floodwall to the eastern tie-in to the MRL at the Caernarvon Canal. Maps illustrating the location of each HSDRRS project reach are provided in appendix D.

Table 2-2. Summary of LPV HSDRRS Components

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
1/S 1	LPV-06a	Bonnet Carré Floodwall	Floodwall	17.5-18	1
1/S 1	LPV-07a	Bayou Trepagnier Drainage Structure	Drainage structure	18	1
1/S 1	LPV -04-2A	St. Charles Levee	Levee	16-18	1
1/S 1	LPV-06b	Shell Pipeline Floodwall	Levee	16.5	1
1/S 1	LPV-06c	Good Hope Floodwall	Floodwall	17.5-18	1
1/S 1	LPV-05-2B	St. Charles Levee	Levee	18	1
1/S 1	LPV-07b	Cross Bayou Drainage Structure	Drainage structure	15.5-18.5	2
1/S 1	LPV-06d	Koch-Gateway Floodwall	Floodwall	17.5-18	2
1/S 1	LPV- 04-1B	St. Charles Levee	Levee	16-18	2
1/S 1	LPV-04-1A	St. Charles Levee	Levee	16-18	2
1/S 1	LPV-07c	St. Rose Drainage Structure	Drainage structure	15.5-18.5	2
1/S 1	LPV-06e	Floodwall under I-310	Floodwall	13.5-15.5	2
1/S 1	LPV-07d	Almedia Drainage Structure	Drainage structure	16	2
1/S 1	LPV-07e	Walker Drainage Structure	Drainage structure	16	2
1/S 1	LPV-06f	Canadian National Railroad Gate	Gate	-1	2
1/S 1	LPV-03d	St. Charles Levee	Levee	16	2
2/S 2	3c	Parish Line Canal Floodwall and Side Berms	Floodwall	17.5	2
2/S 2	3c	Parish Line Canal Breakwater	Breakwater	19.5	2
2/S 2	3a	Parish Line Canal Floodwall	Floodwall	17.5 to 16.5	2
2/S 2	13	Parish Line Canal Floodwall and Gate	Floodwall, gate	17.5	2
3/S 3.a	Reach 1 (LPV-00)	Lake Pontchartrain Levee	Levee	17.5	3
3/S 3.a	LPV-12	Pumping Station #4	Pump	17	3
3/S 3.a	LPV-18	Williams Boulevard Boat Launch Floodwall and Gate	Floodwall	16.5	3
3/S 3.a	Reach 2 (LPV-01)	Lake Pontchartrain Levee	Levee	17.5	3
3/S 3.a	LPV-11	Pumping Station #3	Pump	17	3
3/S 3.a	Reach 3 (LPV-02)	Lake Pontchartrain Levee	Levee	17.5	4
3/S 3.a	LPV-10	Pumping Station #2	Pump	17	4
3/S 3.a	Reach 4 (LPV-19)	Lake Pontchartrain Levee	Levee	17.5	4
3/S 3.a	LPV-17	Causeway Bridge Abutment and Floodwall	Floodwall	16.5	4
3/S 3.a	LPV- 09	Pumping Station #1	Pump	17	4
3/S 3.a	LPV-16	Bonnabel Boat Launch Floodwall and Gate	Floodwall	16.5	4

Table 2-2, continued

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
3/S 3.a	Reach 5 (LPV-20)	Lake Pontchartrain Levee	Levee	17.5	4
4	LPV-101	Lake Marina Avenue Floodwall	Floodwall	16	4
4	LPV-101	Gate L1, L2, L1A, and L5	Gate	16	4
4	LPV-101	Gate L3 and L1B	Gate	16	4
4	LPV-101	Gate L4	Gate	16	4
4	LPV-102	Canal Boulevard Ramp	Ramp	21.1	5
4	LPV-103	Water Stop		NA	5
4	LPV-103	Rail Street	Ramp	18	5
4	LPV-103	Lake Terrace Drive	Ramp	18.5	5
4	LPV-103	Bayou St. John Floodwall	Floodwall	16-18.5	5
4	LPV-103	Sector Gate Closure Structure	Gate	16	5
4	LPV-103	Marconi Drive Gate	Gate	>16	5
4	LPV-103	Bayou St. John Floodwall	Floodwall	18.5	5
4	LPV-104	Pontchartrain Beach Floodwall	Floodwall	18.5-19	5
4	LPV-104	Railroad Gate	Gate	18	5
4	LPV-104	Leroy Johnson Street Gate	Gate	16.5	5
4	LPV-104	Seabrook Floodwall	Floodwall	16.5	5
4	LPV-104	Lakeshore Drive ramps	Ramp	21.7-22.6	5
4	LPV-104	Leroy Johnson Drive and Franklin Avenue Ramps	Ramp	21.7-22.6	5
4	LPV-104	Gate L11	Gate	Current	5
4	LPV-104	Gate L10	Gate	19	5
5	17 th Street	17 th Street Canal	Gate/Pump Station	18	5
5	Orleans Avenue	Orleans Avenue Canal	Gate/Pump Station	18	5
5	London Avenue	London Avenue Canal	Gate/Pump Station	18	5
27	17 th Street	17 th Street Canal	Levee/floodwall	levee wall deep soil mixing	4
27	Orleans Avenue	Orleans Avenue Canal	Levee/floodwall	levee wall deep soil mixing	5,6
27	London Avenue	London Avenue Canal	Levee/floodwall	levee wall deep soil mixing	5,6
11 Tier 2 Pontchartrain	IHNC	Surge protection on IHNC from Lake Pontchartrain	3 Gates		5
6/S 6	LPV-105	Lakefront Airport Floodwall	Floodwall	15.5	5
6/S 6	LPV-105	Downman Road Gate	Gate	15.5	5
6/S 6	LPV-105	Hayne Boulevard Floodwall and Levee	Floodwall	15.5	5
6/S 6	LPV-105	Hayne Boulevard Levee	Levee	13.5	5
6/S 6	LPV-106	Lake Pontchartrain Levee	Levee	13.5	7
6/S 6	LPV-106	Citrus Pump Station Gate and Levee/Floodwall	Fronting Protection	15.5	7
6/S 6	LPV-106	Jahncke Pump Station Gate and Levee/Floodwall	Fronting Protection	15.5	7
6/S 6	LPV-107	Lincoln Beach Floodwall and Levee	Levee	13.5	7

Table 2-2, continued

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
6/S 6	LPV-107	Lincoln Beach Gate	Gate	15.5	7
11/S 11 Tier 2 Borgne	GIWW	MRGO Closure Structure	Closure structure (Floodwall)	24-26	8
11/S 11 Tier 2 Borgne	GIWW	Wetlands Structural Wall Barrier	Barrier (Floodwall)	24	8
11/S 11 Tier 2 Borgne	GIWW	Bayou Bienvenue Gate	Gate (Vertical Lift)	28	8
11/S 11 Tier 2 Borgne	GIWW	GIWW Bypass Gate	Gate (Bypass Barge)	26	8
11/S 11 Tier 2 Borgne	GIWW	GIWW Gate	Gate (Sector)	26	8
7/S 7	LPV-109	Bayou Sauvage Levee	Levee	17-22	9, 10
7/S 7	LPV-109	Bayou Sauvage Drainage Control Structures and Two Pump Stations	Drainage structure	17-22	9, 10
7/S 7	LPV-109	I-10 Ramp	Ramp	19	9
7/S 7	LPV-109	US 11 Gate	Gate	22	10
7/S 7	LPV-109	US 90 Gate	Gate	18.5	11
7/S 7	LPV-110	CSX Railroad Gate and Floodwall	Gate	27.5	11
7/S 7	LPV-111	GIWW Levee	Levee	25 - 29	12
7/S 7	LPV-111	Pump Station #15 Floodwall	Floodwall	30.5	11
10	LPV-145	Bayou Bienvenue to Bayou Dupree	Floodwall	29 - 31	13
10	LPV-146	Bayou Dupree to LA 46	Floodwall	17.5	14
10	LPV-148	Verret to Caernarvon Canal	Floodwall	19.5	15
8	LPV-144.02	Bayou Dupre Control Structure	Control structure (Sector Gate)	31	13
9	LPV-149	Caernarvon Floodwall (MRL to LPV-148 tie-in)	Levee	26	16
9	LPV-149	LA 39 Gate	Gate	26	16
9	LPV-149	NSRR Gate	Gate	26	16
9	LPV-149	Caernarvon Canal Navigable Structure	Gate (Sector)	26	16

NA – Not Applicable

*S - Supplemental

The following is a brief description of the HSDRRS components that compose the LPV projects:

- IER #1 and IER Supplemental #1: *Lake Pontchartrain and Vicinity, La Branche Wetlands Levee, St. Charles Parish, Louisiana*

A total of 9 miles of improved levees and floodwalls parallel the north side of Airline Highway, with a floodwall that passes under I-310 and intersects the western boundary of Louis Armstrong International Airport (IER #1 and IER Supplemental #1, see appendix D, Location Maps #1 and #2). Elevations of the various risk reduction structures range between +16 and +18 ft. The I-310 floodwall was rebuilt to a height of 13.5 ft to 15.5 ft. A levee floodside shift (Reach 1A), replacement of a floodwall with a levee segment (Reach 2A and 2B), the use of geotextile fabric, construction of drainage structures,

construction of new access roads and temporary bridges, the use of cofferdam (Reach 1B), and the use of existing access roads along the La Branche wetlands were incorporated (IER Supplemental #1).

- IER #2 and IER Supplemental #2, *Lake Pontchartrain and Vicinity, West Return Flood Wall, Jefferson and Orleans Parishes, Louisiana*

From the airport, floodwalls were replaced with T-walls along Parish Line Canal at Lake Pontchartrain to elevations of +16.5 to +17.5 ft (IER #2 and IER Supplemental #2, see appendix D, Location Map #2). In addition, breakwaters were constructed at the I-10 Bridge to an elevation of approximately 19.5 ft, with a width of 105 ft and length of 500 ft. Armoring also occurred at the IER #2 levees and floodwalls.

- IER #3, *Lake Pontchartrain and Vicinity, Lakefront Levee, Jefferson Parish, Louisiana*; and IER #3.a, *Lake Pontchartrain and Vicinity, Jefferson East Bank, Jefferson Parish, Louisiana*

From Parish Line Canal to the 17th Street Canal, approximately 9.5 miles of Lake Pontchartrain levee were raised to an elevation of +17.5 ft, and foreshore protection was added along the lakefront. The HSDRRS improvements described in IER #3 also include approximately 2 miles of improved floodwalls and floodgates at boat launches, improvements at the Lake Pontchartrain Causeway Bridge abutment, and fronting protection and breakwaters at four pump stations (IER #3 and IER Supplemental #3.a, see appendix D, Location Maps #3 and #4). The HSDRRS work for construction of wave attenuation berms and foreshore protection (Reaches 1-4) along the Jefferson Parish lakefront, a T-wall, overpass bridge, and detour lane bridge spans at the Causeway Bridge was modified as described in IER Supplemental #3.a. Other work noted in IER Supplemental #3.a includes additional rock armoring of the breakwater, movement of a breakwater access bridge, and construction of an entrance ramp in lieu of a gate within the recurve I-wall.

- IER #4, *Lake Pontchartrain and Vicinity, Orleans East Bank, New Orleans Lakefront Levee, West of Inner Harbor Navigation Canal, Orleans Parish, Louisiana*

From the 17th Street Canal to the west bank of the IHNC (IER #4, see appendix D, Location Maps #4 and #5), seven sections of floodwalls along Lake Marina Avenue, Bayou St. John, Seabrook, and Pontchartrain Beach were improved with either T-walls or L-walls to elevations ranging from +16 to +19 ft. This reach also included rebuilding or retrofitting 11 floodgates for pedestrians, vehicles, and railroads; raising ramps at Leroy Johnson Drive, Franklin Avenue, Lakeshore Drive, and Canal Boulevard; and modifying the Bayou St. John sector gate. Levees between the 17th Street Canal and IHNC were raised to the authorized 100-year risk reduction elevations. The reaches of IER #4, which total approximately 5.8 miles, were split by the work detailed in IERs #5 and #27 (described in the next two paragraphs).

- IER #5, *Permanent Protection System for the Outfall Canals Project on 17th Street, Orleans Avenue, and London Avenue Canals, Jefferson and Orleans Parishes, Louisiana*

Temporary pump stations have been constructed, and new permanent pump stations and closure structures (i.e., gates) at or near the mouth of the 17th Street, Orleans Avenue, and London Avenue outfall canals, which operate in series with the existing Sewage and Water Board of New Orleans (SWBNO) pump stations, are proposed for construction (see appendix D, Location Map #5; IER #5). The pumping capacity at the 17th Street pump station would range between 10,500 and 12,500 cubic ft per second (cfs). The pumping capacity at Orleans Avenue pump station would be 2,700 cfs. The pumping

capacity at London Avenue pump station would be between 8,000 and 9,000 cfs. Under normal conditions, the flow from the canals would discharge through open gates directly into Lake Pontchartrain without having to operate the new pumping station. During those events where the combination of storm surge from Lake Pontchartrain and flow from the existing SWBNO pump stations could create a condition where the safe water elevation in the canals is exceeded, the gates would be closed and the new pump stations operated. Heights of structures associated with the pump station will be minimized and are not to exceed a height of 45 ft. The pump stations tie in to the existing levee system and were raised to the 100-year level of risk reduction. Following operational testing and acceptance of each pump station, the existing interim control structures will be removed and the area restored to pre-construction conditions.

- IER #27, *Outfall Canal Remediation on the 17th Street, Orleans Avenue and London Avenue Canals, Jefferson and Orleans Parish, Louisiana*

Floodwalls were remediated (IER #27) along the three outfall canals (17th Street, Orleans Avenue, and London Avenue) in Jefferson and Orleans parishes (see appendix D, Location Maps #4 through #6). Four remediation methods were implemented to strengthen the canal walls and address three possible failure mechanisms along the outfall canals: seepage, stability, and deflection. The remediation methods included deep soil mixing, net embankment increase/concrete slabs, sheet pile cutoffs, and stability berms.

- IER #6 and IER Supplemental #6, *Lake Pontchartrain and Vicinity, New Orleans East Citrus Lakefront Levee, Orleans Parish, Louisiana*

From the east bank of the IHNC to Paris Road (IER #6 and IER Supplemental #6, see appendix D, Location Maps #5 and #7), approximately 6.2 miles of levees and floodwalls were improved or reconstructed, with some sections realigned, to provide the 100-year level of risk reduction. A cutoff wall to control seepage was installed in 4.18 miles of reconstructed levee. Gates at the Citrus and Jahncke Pump Stations and Lincoln Beach were reconstructed to the 100-year risk reduction elevations, and a new floodgate was built at the Downman Road crossing of the new floodwall. Levees were raised to +13.5 ft, and floodwalls and gates were constructed to +15.5 ft. The original proposed levee construction was modified (IER Supplemental #6) so that the 6.2 miles of levees and floodwalls (approximately 5.4 miles) were raised by the addition of a floodwall (I-wall or T-wall depending on reach) at the crown of the levee (LPV-105.02, LPV-106, and LPV-107) instead of raising the existing earthen levee.

- IER #7 and IER Supplemental #7, *Lake Pontchartrain and Vicinity, New Orleans East Lakefront to Michoud Canal, Orleans Parish, Louisiana*

From Paris Road to South Point (IER #7; see appendix D, Location Maps #9 through #12), the HSDRRS work consisted of reconstructing levees, floodwalls, and floodgates to 100-year risk reduction levels. From South Point to the CSX Railroad floodgate (IER #7 and IER Supplemental #7), approximately 7.5 miles of levee were constructed to an elevation ranging between +17 and +22 ft. From the CSX Railroad to the east bank of the Michoud Canal (IER #7), 5.2 miles of levee were raised to elevations ranging between +25 and +29 ft. Floodgates with T-wall floodwall tie-ins to the levee were constructed at the crossing of U.S. Highway 11 (US 11), U.S. Highway 90 (US 90), and the CSX Railroad, and the I-10 ramp was raised over the levee. The project work at LPV-109 and LPV-111 was modified (IER Supplemental #7) to include additions to construction limits at both reaches, temporary road closure at Highway 11 and a temporary traffic control bridge on I-10 at Irish Bayou, raising and relocation of the USFWS pump station, and construction of a T-wall along portions of LPV-111.

- IER #11, *Improved Protection on the Inner Harbor Navigation Canal, Orleans and St. Bernard Parishes, Louisiana*, and IER #11 Tier 2 Pontchartrain, *Improved Protection on the Inner Harbor Navigation Canal, Orleans Parish, Louisiana*

To address storm surge originating from Lake Pontchartrain, a storm surge protection feature was built within the IHNC (see appendix D, Location Map #5). The exact alignment for this storm surge protection feature was determined after the IER #11 Tier 1 document analyzed programmatic alternatives for a range of potential alignments. The construction project described by IER #11 Tier 2 Pontchartrain consists of a sector gate and two vertical lift gates in the IHNC, 540 ft south of the Senator Ted Hickey Bridge (also known as Seabrook Bridge) and the Bascule Railroad Bridge, with floodwall tie-ins to LPV-104 to the west and LPV-105 to the east. This HSDRRS project, which improves the flood risk reduction along the IHNC, also included a 20 ft wide vehicle ramp in the eastern floodwall to provide access to Jourdan Road.

- IER #11, IER #11, Tier 2 Borgne, and, IER Supplemental #11 Tier 2 Borgne, *Improved Protection on the Inner Harbor Navigation Canal, Orleans and St. Bernard Parishes, Louisiana*

A major new feature of the HSDRRS consists of the IHNC Borgne barrier (IER #11 Tier 1, Tier 2 Borgne, and S11 Tier 2 Borgne) (photograph 2-1). This project proposes to reduce the risks in the LPV areas due to storm surge coming from the Gulf of Mexico and Lake Borgne (see appendix D, Location Map #8). The Borgne barrier consists of approximately 2 miles of a new floodwall/gated system extending from the Michoud Canal floodwall north of the GIWW to the HSDRRS levee on the west side of the deauthorized MRGO. The floodwall/gates system crosses the GIWW, Bayou Bienvenue, the deauthorized MRGO, and the Golden Triangle marsh. Included in this work are a flood control sector gate and bypass barge gate at the GIWW (approximately 1,150 ft east of the Michoud Canal), a new navigable vertical lift gate at Bayou Bienvenue (IER Supplemental #11 Tier 2 Borgne), and a braced concrete wall (barrier) across the MRGO (approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure), with the concrete floodwall constructed across the marsh between these waterways. The wall was built to elevations ranging from approximately +24 ft to +26 ft and the gates were built to +26 ft.



Photograph 2-1. IER #11 HSDRRS Borgne barrier under construction.

The Borgne barrier (IER #11 Tier 2 Borgne) works in tandem with the Seabrook Floodgate Complex (IER #11 Tier 2 Pontchartrain) to reduce the risk of storm surge in low-lying areas within the Greater New Orleans Metropolitan Area and St. Bernard Parish.

- IER #8, *Lake Pontchartrain and Vicinity, Bayou Dupre Control Structure, St. Bernard Parish, Louisiana*

At Bayou Dupre (IER #8; see appendix D, Location Map #13), a new flood control structure with steel sector gates and floodwall tie-ins was constructed to an elevation of +31 ft on the flood side of and adjacent to the existing structure.

- IER #10, *Lake Pontchartrain and Vicinity, Chalmette Loop Levee, St. Bernard Parish, Louisiana*

In St. Bernard Parish, approximately 22 miles of T-wall were constructed atop the existing Chalmette Loop Levee (IER #10, see appendix D, Location Maps #13 through #15). The T-wall elevation is approximately +29 ft, except along the MRGO where the elevation varies from +29 to +31 ft. At the intersection of the Chalmette Loop Levee and Louisiana Highway 46 (LA 46), a gate was built and an existing gate across Bayou Road was replaced by a +31 ft floodgate.

- IER #9, *Lake Pontchartrain and Vicinity, Caernarvon Floodwall, St. Bernard Parish, Louisiana*

The existing Caernarvon Floodwall (LPV-149) complex on the east side of the Caernarvon Freshwater Diversion Canal (CFDC) (see appendix D, Location Map #16) was replaced (IER #9). From the northernmost extent, the new alignment includes the following: a tie-in to the MRL system in Plaquemines Parish; new floodgates across Louisiana Highway 39 (LA 39) and the Norfolk Southern Railroad (NSRR); a T-wall with an elevation of approximately +26 ft along the east bank of the CFDC (west of the Shallow Draft EBI property and the Delacroix Corporation's Caernarvon Boat Launch), then turning southeast and east to the Caernarvon Canal; a 56 ft wide navigable structure across the Caernarvon Canal with an elevation of approximately +26 ft but south of the EBI; a continuation of the floodwall from the Caernarvon Canal east to the existing LPV Chalmette Loop levee (LPV-148); and a tie-in to the MRL (see appendix D, Location Map #16).

Earthen levees were constructed at the 2011, 100-year design elevation, while hardened structures, such as floodwalls, floodgates, and sector gates, were constructed to the 2057, 100-year design elevations. Levees would be "lifted" or raised as needed, if authorized and funded, to maintain their elevation at the 100-year level required for NFIP FEMA certification in order to accommodate consolidating soils, subsidence, and sea-level rise. These future elevations may be different from the elevation constructed at the 2011, 100-year design elevation. Therefore, it is anticipated that certain reaches of the HSDRRS earthen levees would require multiple levee lifts through 2057, and the amount of borrow material required for all of these levee lifts is estimated to be approximately 7.3 million cy. A list of the proposed 17 HSDRRS LPV levee lifts (i.e., all lifts anticipated for the HSDRRS levees through 2057) for the 50-year life of the HSDRRS is shown in table 2-3.

Table 2-3. Proposed Levee Lifts by Reach for the HSDRRS LPV Reaches (HSDRRS 2057)

HSDRRS Reach	Sub-basins	Parish	Approximate Miles of Levee	Number of Levee Lifts Proposed
LPV-00.2 Reach 1 Lakefront Levee Phase 2	Jefferson East Bank	Jefferson	2.0	2
LPV-01.1 Reach 2 Lakefront Levee Phase 2	Jefferson East Bank	Jefferson	1.5	2
LPV-03d Airport Runway 10 Levee Phase 2	St. Charles	St. Charles	0.3	4
LPV-04.2A Levee from Cross Bayou to St. Rose and Gulf South Floodwall	St. Charles	St. Charles	1.1	3
LPV-04.2B Levee Reach from I-310 to Walker Drainage Structure	St. Charles	St. Charles	1.9	3
LPV-05.2A Levee Shell Pipeline to Goodhope and Shell Pipeline Floodwall	St. Charles	St. Charles	0.9	2
LPV-05.2B Levee from Goodhope to Cross Bayou	St. Charles	St. Charles	2.0	2
LPV-19.2 Lakefront Levee	Jefferson East Bank	Jefferson	1.5	2
LPV-20.1 Lakefront Levee	Jefferson East Bank	Jefferson	1.7	2
LPV-102.01 Lake Marina Avenue to Orleans Ave Canal	Orleans East Bank	Orleans	0.6	1
LPV-103.01 Orleans Ave Canal to London Ave Canal	Orleans East Bank	Orleans	1.4	1
LPV-104.01 London Ave Canal to IHNC	Orleans East Bank	Orleans	1.8	1
LPV-106 Rock Breakwater Citrus Lake Levee*	New Orleans East	Orleans	4.1	4
LPV-109.02a South Point to CSX RR	New Orleans East	Orleans	7.5	1
LPV-145 Chalmette Loop: Bayou Bienvenue to Bayou Dupre	Chalmette Loop	St. Bernard	6.4	1
LPV-146 Chalmette Loop: Bayou Dupre to LA 46	Chalmette Loop	St. Bernard	7.7	1
LPV-148.02 Chalmette Loop: LA 46 to River	Chalmette Loop	St. Bernard	8.2	1

*Not earthen levee but rock breakwater

2.2.2 Description of WBV-related IERs

The WBV portion of the HSDRRS consists of various projects providing 100-year level of risk reduction for the west bank parishes and communities. The projects include earthen levees, new T-wall floodwalls, roadway and railroad floodgates, sector gates, pump structures, and elevated highway and roadway ramps. WBV projects provide approximately 91 miles of 100-year risk reduction improvements from the western tie-in to the MRL near the Davis Pond Diversion to the MRL tie-in at Oakville (see figure 2-1). The WBV portion of HSDRRS reduces risk in the communities of Ama, Waggaman, Avondale, Bridge City, Westwego, Marrero, Harvey, Gretna, Algiers, Belle Chasse, Oakville, and surrounding areas.

As described in section 1.2.1, the structural height and design to meet the new 100-year level of risk reduction for the HSDRRS was determined using the JPM-OS Process. Levees and floodwalls were constructed to the same design elevation standards as described in section 1.2.1.

Table 2-4 lists the IERs for the WBV component of the HSDRRS from east to west commencing at the western tie-in to the MRL near the Davis Pond Diversion to the MRL tie-in at Oakville in Plaquemines Parish, thereby closing the HSDRRS sub-basin loop. The WBV HSDRRS improvements to levees, floodwalls, and closure and drainage structures commence at the Harvey Canal and proceed through a portion of the U.S. Environmental Protection Agency (USEPA) Bayou aux Carpes CWA Section 404(c) wetlands area and Bayou Segnette State Park, and end at the MRL tie-in at the Outer Cataouatche Canal near US 90.

Table 2-4. WBV Projects Included in the HSDRRS

IER* #	Sub-basin	Parish	Short Title	Decision Record Date
13	Belle Chasse	Plaquemines	Hero Canal Levee and Eastern Terminus	December 4, 2009
12	Gretna-Algiers	Jefferson, Orleans, Plaquemines	GIWW, Harvey and Algiers Canal Levee and Floodwalls	February 18, 2009
14/S 14.a	Harvey-Westwego	Jefferson	Westwego to Harvey Levee	August 26, 2008/ February 9, 2010
15	Lake Cataouatche	Jefferson	Lake Cataouatche Levee	June 12, 2008
16/S 16.a	Lake Cataouatche	Jefferson	Western Terminus Levee	June 12, 2009/ August 24, 2010
17	Lake Cataouatche	Jefferson	Company Canal Floodwall	January 21, 2009

*S - Supplemental

Table 2-5 summarizes the WBV component projects of the HSDRRS beginning in the east, with the tie-in with the MRL at Oakville, proceeding on to the west, to the tie-in at the MRL at the Davis Pond Diversion. Location maps for all WBV component projects are located in appendix D.

Table 2-5. Summary of WBV HSDRRS Components

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
13	Eastern	Hero Canal Levee and Eastern Terminus	Levee and Pump Station	14	19
12	Eastern	Levee and Bayou Road realignment	Levee	14	19
12	Eastern	Closure complex	Gate	16	19
12	Eastern	Eastern floodwall	Floodwall	16	19
12	Northern	Northern floodwall	Floodwall	14-16	19
12	Western	Western levee	Levee	14	19
12	Detention Basin Improvements	Harvey Canal west bank levees	Berm	8.5	20
12	Detention Basin Improvements	Hero cutoff to Belle Chasse Hwy (east)	Berm	8.5	19
12	Detention Basin Improvements	Algiers lock to Belle Chasse Hwy (west)	Berm	8.5	17

Table 2-5, continued

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
14	WBV-14e	V-line levee	Floodwall	14	19
14	WBV-14e	V-line levee	Levee	14	19
14	WBV-14d	V-line levee floodwall	Floodwall	14	19
14	WBV-14f	LA 45 to V-line levee floodwall	Gate	16	20
14	WBV-14f	LA 45 to V-line levee floodwall	Levee	14	20
14	WBV-14b	Orleans Village Pump Station to LA 45	Levee	14	20
14	WBV-43	Mount Kennedy Pumping Station	Floodwall	16	20
14	WBV-37	Ames Pumping Station	Floodwall	16	20
14/S 14.a	WBV-14b	Orleans Village Pump Station to LA 45	Floodwall	14	20
14	WBV-30	Westminster Pump Station	Floodwall	16	21
14/S 14.a	WBV-14c	North levee	Levee	14	21
14/S 14.a	WBV-14c	North levee	Floodwall	14	21
17	Reach 5	Company Canal floodwall	Levee	14	21
17	Reach 3 (WBV-16)	Company Canal floodwall	Levee	14	21
17	Reach 3 (WBV-22)	Company Canal floodwall	Floodwall, Sector Gate, Pump Station	14	21
17	Reach 2 (WBV-16b)	Company Canal floodwall	Floodwall	14	21
17	Reach 1 (WBV-24)	Company Canal floodwall	Floodwall	14	21
15	Reach 2 (WBV-18.2 and 15a.2)	Browning-Ferris Industries, Inc. (BFI) landfill to Bayou Segnette State Park	Levee	11.5 ¹	22
15	Reach 3 (WBV-15b.2)	Pump Stations No.1 & No.2 floodwall	Floodwall	11.5 ¹	22
15	Reach 1 (WBV-17b.2)	US 90 to BFI landfill	Levee	11.5 ¹	22
S 16.a	Reach 1	Outer Cataouatche Canal and Levee to Bayou Verret: Pump Station Demolition and Construction	Closure	15.5	22
16	Reach 1	Bayou Verret	Gate	15.5	22
16	Reach 1	Bayou Verret Closure Structure to Cataouatche levee	Levee	15.5	22
16	Reach 1	Bayou Verret Closure Structure to Cataouatche levee	Floodwall	15.5	22
S 16.a	Reach 2	Bayou Verret to US 90 Crossing Levee: Adding Bank Stabilization	Closure	15.5	22
16	Reach 2	Outer Cataouatche Canal to Bayou Verret	Floodwall	15.5	22
16	Reach 2	Outer Cataouatche Canal to Bayou Verret	Levee	15.5	22
S 16.a	Reach 3	US 90 Crossing Permanent Access for US 90	Crossing	15.5	23
S 16.a	Reach 3	Nine Utility Crossings	Floodwall	15.5	23

Table 2-5, continued

IER* #	Reach	Component	Type	Design Elevation (ft NAVD 88)	Location Map Number
16	Reach 3	Raise US 90 crossing over floodwall	Floodwall	15.5	23
16	Reach 4	US 90 crossing to Davis Pond Diversion levee	Levee	13.5	23
16	Reach 4	US 90 crossing to Davis Pond Diversion levee	Floodwall	13.5-15.5	23
S 16.a	Reach 5	Levee on East Side of the Davis Pond Diversion Project to MRL	Ramp	13.5	23
S 16.a	Reach 5	Four Utility Crossings	Levee	13.5	23
16	Reach 5	Davis Pond Diversion to MRL	Levee	13.5	23
16	Reach 5	Davis Pond Diversion to MRL	Floodwall	13.5	23

1. Authorized 2007 elevation NGVD.

*S - Supplemental

The following describes, from east to west, the WBV project components of HSDRRS, as well as adjacent local structures.

- IER #13, *West Bank and Vicinity, Hero Canal Levee and Eastern Tie-in, Plaquemines Parish, Louisiana*

The HSDRRS reaches described by IER #13 begin at Hero Canal, south of the confluence of the Algiers and Harvey canals off of the GIWW (see appendix D, Location Map #19). In Reach 1, north of Hero Canal, the existing levee was enlarged with a protected-side shift included for approximately 2.3 miles to +14 ft. Reach 2 included a new 56 ft wide stoplog closure structure (IER #13). Also in Reach 2, south of Hero Canal, the earthen levee was raised to 14 ft for 1,400 linear ft southward and for 1,360 linear ft eastward on the south side of the landfill until it intersects with a non-Federal levee. Improvements were made to the non-Federal levees to match the new Federal levee at a 14 ft elevation. A new 150 cfs pump station was built south and east of the landfill with a T-wall, vehicular floodgates, and a railroad gate constructed to 14 ft elevation. From the railroad to the MRL, a new earthen levee was constructed also with a 14 ft elevation.

- IER #12 and IER Supplemental #12, *GIWW, Harvey, and Algiers Levees and Floodwalls, Jefferson, Orleans, and Plaquemines Parishes, Louisiana*

The GIWW, Harvey, and Algiers canals' levees and floodwalls (IER #12 and IER Supplemental #12; see appendix D, Location Maps #17, #19, and #20) included approximately 5 miles of levee construction, 1.5 miles of floodwalls, and 2.8 miles of protected side berms. Elevations ranged between +14 and +16 ft. The major feature was the construction of a new surge barrier in the GIWW just downstream of the confluence of the Harvey and Algiers canals (photograph 2-2). The surge barrier consists of a main channel gate, a bypass channel



Photograph 2-2. Harvey Canal sector gate.

gate, and a 20,000 cfs pump station, all at an elevation of +16 ft. The new alignments eliminated approximately 25 miles of parallel protection along the Harvey and Algiers canals from the primary line of defense while providing greater certainty of risk reduction. Additionally, this project and the IER #14 project were designed to minimize impacts on the Bayou aux Carpes CWA Section 404(c) wetlands.

- IER #14 and IER Supplemental #14, West Bank and Vicinity, Westwego to Harvey Levee, Jefferson Parish, Louisiana

From the Westwego pumping station, the Westwego to the Harvey levee (IER #14 and IER Supplemental #14.a; see appendix D, Location Maps #19 through #21) included 12.5 miles of earthen levees (10.6 miles) and floodwalls (1.9 miles) within the existing ROW. A 100 ft flood-side shift for the 12.5 miles of earthen levee was required (IER Supplemental #14.a). Fronting protection at the Westminster, Ames, and Mount Kennedy pumping stations, with additional ROW required for staging areas at these pump stations, was also described. All levee and floodwall sections were improved to elevations of +14 ft. Floodwalls at the pumping stations were built at +16 ft elevations for structural superiority.

- IER #17, West Bank and Vicinity, Company Canal Floodwall, Jefferson Parish, Louisiana

Approximately 9,000 ft of floodwalls along Bayou Segnette State Park and Company Canal were replaced or newly constructed at an elevation of +14 ft (IER #17; see appendix D, Location Map #21). Included in this project segment was a new fronting protection floodwall at the Bayou Segnette pumping station and a new 2,000 ft long earthen levee, at an elevation of +14 ft, that crosses a dredge material disposal area located just north of Lapalco Boulevard and connects to a new floodwall section at the new levee's terminus on the eastern bank of the bayou. A new pump station and sector gate were constructed at an elevation of +16 ft and incorporated into the new levee. Approximately 1,600 ft of existing earthen levee with a floodwall cap on the eastern bank of Bayou Segnette was replaced with an earthen levee (+14 ft) terminating at the new Westwego pumping station.

- IER #15, West Bank and Vicinity, Lake Cataouatche Levee, Jefferson Parish, Louisiana

The Lake Cataouatche levee (IER #15; see appendix D, Location Map #22) HSDRRS work included approximately 7.6 miles of earthen levee, beginning at US 90 and terminating at Bayou Segnette State Park, with 1,450 ft of total floodwall at two pumping stations. The levee required a 110 ft flood-side shift and was constructed to the authorized elevation of +11.5 ft NGVD. Floodwalls at the two pump stations were constructed at an elevation of +15.5.

- IER #16 and IER Supplemental #16.a, West Bank and Vicinity, Western Tie-in, Jefferson and St. Charles Parishes, Louisiana

The HSDRRS improvements on the West Bank began with the Western Terminus Levee (IER #16 and IER Supplemental #16.a; see appendix D, Location Maps #22 and #23) that ties into the MRL downriver of the Davis Pond Diversion, runs along the eastern bank of the diversion canal, crosses US 90 and the Outer Cataouatche Canal, then runs south of and parallel to the canal crossing at Bayou Verret, terminating 2,400 ft east of Bayou Verret with an earthen closure of the Outer Cataouatche Canal. The total length of the HSDRRS levee/floodwalls was approximately 4.5 miles and ranged in elevation from +13.5 ft along the diversion canal to +15.5 ft along the majority of the levee from the diversion canal to the tie-in with the Lake Cataouatche levee. An additional 255 acres of

ROW were needed to accommodate the HSDRRS construction. A total of 2,400 ft of the existing Davis Pond East Guide Levee was degraded, a pump station located along the Lake Cataouatche Levee southeast of the existing US 90 pump station was constructed, and bank stabilization was provided for an earthen closure of the Outer Cataouatche Canal (IER Supplemental #16.a). The temporary detour at US 90 was left in place, a navigable closure structure in Bayou Verret was constructed, and a ramp was built instead of a floodgate at US 18 (IER Supplemental #16.a). This required an additional 8.3 acres of ROW.

As mentioned in section 2.2.1, the earthen levees were constructed to the 2011, 100-year risk reduction design elevation. To continue to provide the 100-year level of risk reduction through 2057 will require, if authorized and funded, that the levees be “lifted” or raised as needed to maintain the NFIP FEMA certification. A list of the proposed 23 HSDRRS WBV levee lifts for the 50-year period of analysis of the HSDRRS is shown in table 2-6.

Table 2-6. Proposed Levee Lifts by Reach for the HSDRRS WBV Risk Reduction (HSDRRS 2057)

HSDRRS Reach	Sub-basins	Parish	Approximate Miles of Levee	Number of Levee Lifts Proposed
WBV-06a.s Belle Chasse Hwy to Hero Cutoff (West)	Gretna-Algiers	Plaquemines	4.7	TBD
WBV-09a Hero Canal to Oakville	Belle Chasse	Plaquemines	0.1	TBD
WBV-12 Harvey Canal Reach 1	Belle Chasse	Plaquemines	2.4	TBD
WBV-14.a.2 Harvey Canal West Bank Levee	Harvey-Westwego	Jefferson	2.7	2
WBV-14.b.2 Orleans Village to LA 45 Levee	Harvey-Westwego	Jefferson	2.8	2
WBV-14.c.2 New Westwego Pump Station to Orleans Village	Harvey-Westwego	Jefferson	3.5	3
WBV-14.e.2 V-Line Levee east of Vertex	Harvey-Westwego	Jefferson	2.9	2
WBV-14.f.2 LA 45 Levee	Harvey-Westwego	Jefferson	2.9	1
WBV-14.i V-line Levee, LA 3134 Highway Crossing	Harvey-Westwego	Jefferson	0.1	1
WBV-15.a.2 Lake Cataouatche Pump Station to Segnette State Park	Lake Cataouatche	Jefferson	4.0	2
WBV-17.b.2 Station 160+00 to US 90	Lake Cataouatche	Jefferson	0.7	2
WBV-18.2 US 90 to Lake Cataouatche	Lake Cataouatche	Jefferson	2.8	2
WBV-48.2 Belle Chasse to Algiers Lock (East)	Belle Chasse	Orleans, Plaquemines	3.6	TBD
WBV-49.1 Hero Levee to Belle Chasse Hwy (East)	Belle Chasse	Plaquemines	4.9	TBD
WBV-71 Western Tie-In Levees North-South	Lake Cataouatche	St. Charles	0.9	3
WBV-72 Western Tie-In Levees East-West	Lake Cataouatche	St. Charles, Jefferson	2.8	3
WBV-90 GIWW- Western Closure Complex	Gretna-Algiers Belle Chasse	Jefferson, Plaquemines	2.3	2
WBV-MRL Co-located levees* (WBV-MRL 1.2a, 1.2b, 2.2, 3.2, 4.2, & 5.2)	Belle Chasse	Plaquemines, Orleans	15.38	TBD

*Actually six reaches

2.3 BORROW HSDRRS COMPONENTS

The USACE conducted an unprecedented search for suitable clay material to rebuild and reinforce the HSDRRS in the Greater New Orleans Metropolitan Area. The USACE engineers originally estimated that over 100 million cy of suitable material was required for the HSDRRS projects (all 350 miles of improvements – not just the 217 miles of the HSDRRS described in the CED). Currently, the borrow requirement is estimated at approximately 93 million cy of material to complete the construction of the HSDRRS risk reduction levees and floodwalls, as well as other non-Federal and other USACE flood risk reduction projects. It is projected that an additional amount of approximately 7.3 million cy of suitable borrow material would be required for the HSDRRS earthen levee lifts until the year 2057, in order to continue to provide the 100-year level of risk reduction.

Earthen levee construction requires a specific type of clay material that compacts well and prevents seepage. Before borrow material was used for levee construction, soil borings, testing, and environmental clearance were completed. The borrow site investigation took as long as 6 to 9 months to complete. Additionally, for a borrow site to be considered suitable, no jurisdictional wetlands could be directly impacted during the excavation of borrow and use of the site.

The term “suitable” as it relates to borrow material discussed in this document is defined as meeting the following criteria after placement as levee fill:

- Soils classified as fat or lean clays are allowed as per the Unified Soils Classification System.
- Soils with organic content greater than 9 percent are not allowed.
- Soils with plasticity indices less than 10 are not allowed.
- Soils classified as silts are not allowed.
- Clays will not have more than 35 percent sand content.

The USACE pursued three overall methods for acquiring suitable borrow material: government-furnished borrow, contractor-furnished borrow, and supply contract borrow. When utilizing the government-furnished borrow method, the USACE first identified the borrow source location, then investigated and approved the borrow material as suitable for use. The acquisition of the real estate interest over the land was in the name of the Federal government or a non-Federal sponsor. The borrow site was then made available to all the HSDRRS contractors through advertised Plans and Specifications (P&S). When using the contractor-furnished borrow method, the USACE required a contractor to provide their own borrow material; during the HSDRRS construction, the Federal government provided the contractor with a list of approved borrow sites, but the contractor was ultimately responsible for providing the borrow material for construction. The contractor entered into a contractual agreement with the landowner (not with the USACE) to acquire the necessary borrow material. When using the supply contract borrow method, the USACE allowed supply contractors to bid on task orders for the supply of borrow material, which was then used by the USACE and contractors for construction of the HSDRRS.

These three methods enabled the USACE or a non-Federal sponsor to either acquire a borrow site or have the construction contractor and borrow landowner enter into contractual agreements, or enabled contractors to bid directly on task orders for the supply of borrow from any of the contractor-furnished borrow sites.

As of November 15, 2010, 11 IERs were prepared to address the provision of suitable borrow material for the construction of the HSDRRS (table 2-7). This provided environmental clearance for more borrow sites (68 in total) than have been used to date (25 in total), and provides more suitable material than will be needed to construct the HSDRRS to 2011, 100-year risk reduction elevations. Additionally, based on projections of material needs, restrictions for use due to local

ordinances, and other available sources, some of the government-furnished Westbank borrow sites will likely never be used. However, future levee lifts, if authorized and funded, would require additional suitable borrow material. The IERs prepared for the 2011 HSDRRS construction do not provide the environmental clearance necessary for these future levee lifts.

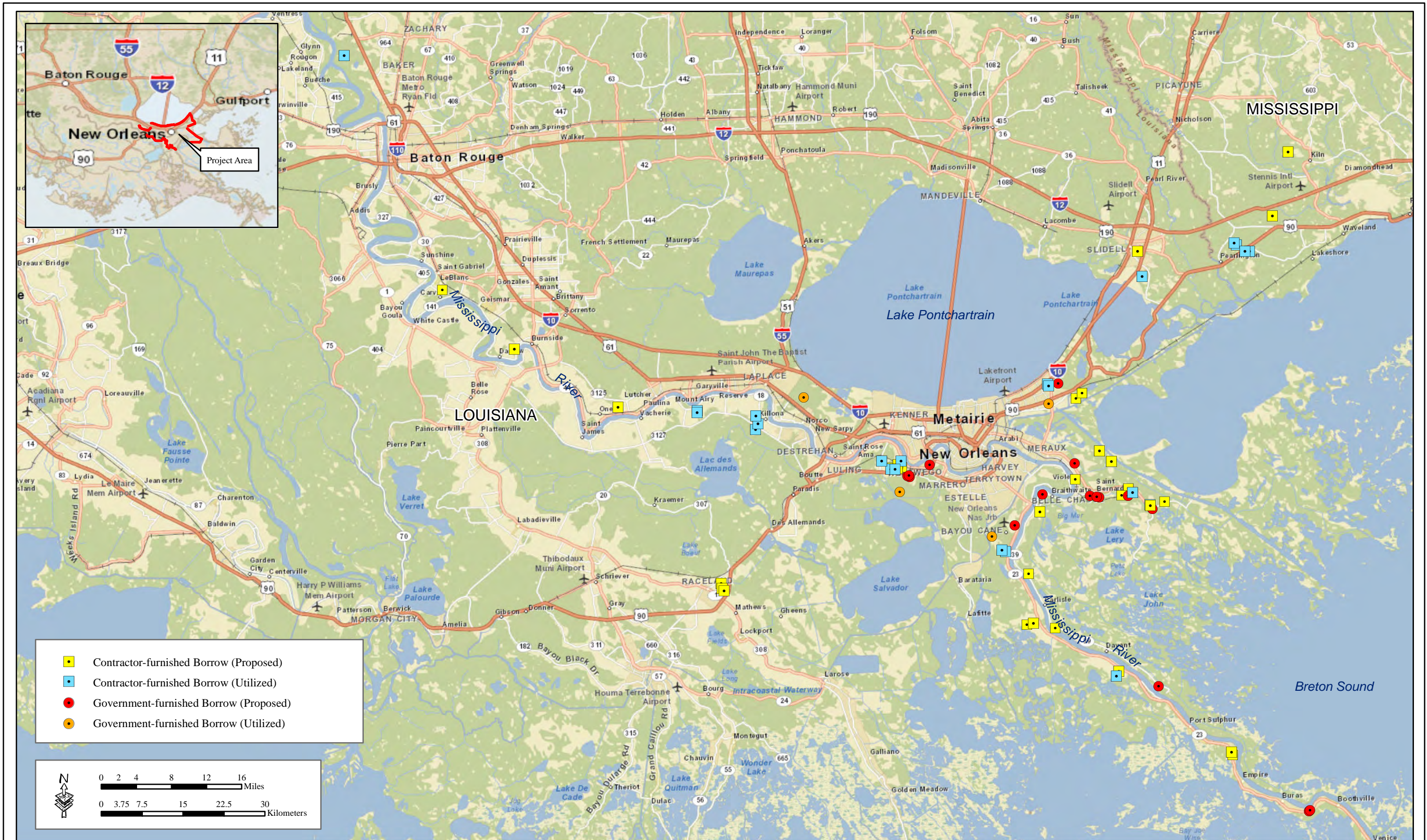
Table 2-7. List of Borrow IERs

IER #	Borrow Type	Number of Proposed Borrow Sites	Borrow Sites within HSDRRS Project Area Sub-basins	Parish/County Borrow Site Locations outside of HSDRRS Project Area	Decision Record Date
18	GF	12	New Orleans East, Chalmette Loop, Belle Chasse, Lake Cataouatche	Plaquemines Parish, St. Bernard Parish, St. Charles Parish	February 21, 2008
19	CF	9	New Orleans East, Chalmette Loop, Lake Cataouatche	Iberville Parish, Plaquemines Parish, Hancock County	February 14, 2008
22	GF #2	5	Belle Chasse, Lake Cataouatche	Plaquemines Parish	May 30, 2008
23	CF #2	6	NA	Plaquemines Parish, St. Bernard Parish, St. Charles Parish, Hancock County	May 6, 2008
25	GF Material #3	6	New Orleans East, Lake Cataouatche	Plaquemines Parish	February 3, 2009
26	CF #3	5	Lake Cataouatche	Plaquemines Parish, St. John the Baptist Parish, Hancock County	October 20, 2008
28	GF #4	2*	Chalmette Loop, Lake Cataouatche	Plaquemines Parish	July 31, 2009
29	CF #4	3	New Orleans East	St. John the Baptist Parish, St. Tammany Parish	September 8, 2009
30	CF #5	3	Chalmette Loop	St. James Parish, Hancock County	September 28, 2009
31	CF #7	10	Chalmette Loop, Lake Cataouatche	East Baton Rouge Parish, Lafourche Parish, Plaquemines Parish, St. Bernard Parish, St. Tammany Parish, Hancock County	October 29, 2010
32	CF #6	7	NA	Ascension Parish, Plaquemines Parish, St. Charles Parish	January 22, 2010

*Includes an access road

NA=Not Applicable; GF=government-furnished; CF=contractor-furnished

The USACE assessed the impacts of using the proposed borrow areas on various resources, including non-jurisdictional BLH forest, non-wetlands/upland resources, navigable waters, prime and unique farmland, fisheries, wildlife, threatened and endangered species, cultural resources, recreational resources, noise quality, air quality, water quality, transportation, aesthetics, HTRW, and socioeconomic resources. Jurisdictional wetlands were avoided as a site selection criterion and were not directly impacted at borrow sites. Non-jurisdictional BLH was mitigated in advance of borrow site use through the purchase of credits at mitigation banks. Borrow IERs considered sites that were both within and outside of the HSDRRS sub-basins. Figure 2-3 indicates the geographical range of the borrow sites that the USACE could have utilized for the HSDRRS construction. Appendix D provides location maps of each borrow site.



Note: Please see appendix D for borrow site location maps

Figure 2-3: Geographical Range of HSDRRS Borrow Sites

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Since the beginning of the HSDRRS construction, only 25 of the proposed borrow sites described in the 11 IERs have been utilized (as of July 2011), as indicated in figure 2-3.

For environmental quality control, a Borrow Area Management Plan was required, which included details regarding site excavation, stockpile areas, access roads, and staging areas. To minimize land impacts, borrow pit depths were suggested in the Borrow Area Management Plan.

The contractor-furnished borrow sites are privately owned and, although utilized by the USACE's contractors, the Federal government cannot require the borrow site landowners to ultimately reuse their site in a particular manner. Likewise, the USACE-directed landscaping would only occur where practicable and desired by private landowners at any contractor-furnished borrow sites, as mentioned in several of the Borrow IERs. Direct impacts on jurisdictional wetlands were avoided during the evaluation of suitable borrow sites. Mitigation for non-jurisdictional BLH impacts associated with contractor-furnished borrow sites is being implemented by contractors through the purchase of mitigation credits from mitigation banks. As of September 2011, impacts on approximately 117.15 acres (65.97 AAHUs) of non-jurisdictional BLH forest were mitigated in association with the HSDRRS excavation of contractor-furnished borrow areas.

2.3.1 Individual Environmental Report #18

In IER #18, the USACE analyzed the excavation of 12 government-furnished borrow areas in Orleans, Plaquemines, St. Charles, and St. Bernard parishes, Louisiana. Borrow areas investigated in this IER would provide approximately 26.5 million cy of suitable material for levee and floodwall projects. The action consisted of removing all suitable material from 12 borrow areas; these sites are summarized in table 2-8.

Table 2-8. Government-Furnished Borrow IER #18

Borrow Area Location	Parish	Estimated Suitable Borrow (cy)	Utilized as of July 2011
1418/1420 Bayou Road area located on the south side of Bayou Road	St. Bernard Parish	439,000	
1572 Bayou Road area located on the south side of Bayou Road	St. Bernard Parish	164,000	
910 Bayou Road area located on the south side of Bayou Road	St. Bernard Parish	117,000	
4001 Florissant area located on the south side of Florissant Highway	St. Bernard Parish	214,000	
Dockville area located on the north side of Bayou Road	St. Bernard Parish	1,000,000	
Belle Chasse Naval Air Base	Plaquemines Parish	207,000	
Triumph area located on the south side of LA 23, near Boothville	Plaquemines Parish	50,000	
Maynard area located west of I-510 near the intersection with I-10	Orleans Parish	438,000	X
Cummings North area located on the east side of Michoud Boulevard	Orleans Parish	4,000,000	
Churchill Farms Pit A area located on the south side of US 90	Jefferson Parish	1,150,000	X
Westbank Site G area located on the south side of US 90	Jefferson Parish	1,800,000	

Table 2-8, continued

Borrow Area Location	Parish	Estimated Suitable Borrow (cy)	Utilized as of July 2011
Bonnet Carré Spillway area between the Mississippi River and Airline Highway, which has been used as a government-furnished borrow source since 1985	St. Charles Parish	16,932,000	X
Total		26,511,000	

2.3.2 Individual Environmental Report #19

IER #19 analyzed the excavation of nine contractor-furnished borrow areas in Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines parishes, Louisiana, and Hancock County, Mississippi. Borrow areas investigated in this IER would provide approximately 8.4 million cy of suitable material for levee and floodwall projects. The action consisted of removing all suitable material from nine borrow areas (table 2-9). Table 2-9 provides the list of borrow sites utilized for the HSDRRS construction as of July 2011.

Table 2-9. Contractor-Furnished Borrow IER #19

Borrow Area Location	Parish/County	Estimated Suitable Borrow (cy)	Utilized as of July 2011
River Birch Phase 1 area located on US 90, approximately 0.7 mile west of Live Oak Boulevard	Jefferson Parish	200,000	
River Birch Phase 2 area located on US 90, approximately 0.7 mile west of Live Oak Boulevard	Jefferson Parish	3,500,000	X
The Kimble #2 area located between LA 39 and LA 15	Plaquemines Parish	120,000	
Pearlington Dirt Phase 1 area located off of US 90	Hancock County, Mississippi	1,000,000	X
Eastover area located north of Dwyer Road	Orleans Parish	900,000	X
Sylvia Guillot area located at 3008 Bayou Road	St. Bernard Parish	270,000	
Gatien-Navy Camp Hope area located on East St. Bernard Highway	St. Bernard Parish	200,000	
DK Aggregates area located on LA 46	St. Bernard Parish	1,400,000	
St. Gabriel Redevelopment area located near Carville	Iberville Parish	800,000	
Total		8,390,000	

2.3.3 Individual Environmental Report #22

The USACE analyzed five borrow areas in IER #22 within Jefferson and Plaquemines parishes for use under the government-furnished borrow material program to supply levee building material to the HSDRRS. Borrow areas investigated in this IER potentially provided approximately 6 million cy of suitable material for levee and floodwall projects. The Proposed Action consisted of potentially removing all suitable material from the following five borrow areas: Brad Buras, Tabony, and Westbank N in Plaquemines Parish, and Westbank F and Westbank I in Jefferson Parish. The quantity of borrow material available from each site was not provided in IER #22. As of July 2011, only the Westbank N site was utilized for the HSDRRS construction; Westbank F and Westbank I will likely not be utilized in the future.

2.3.4 Individual Environmental Report #23

Five borrow sites located in St. Bernard, St. Charles, and Plaquemines parishes and Hancock County, Mississippi, were identified in IER #23 for use under the contractor-furnished borrow to

supply levee building material to the HSDRRS. Borrow areas investigated in this IER potentially provided approximately 16.3 million cy of suitable material for levee and floodwall projects. The Proposed Action consisted of potentially excavating all suitable material from the following five borrow areas: 1025 Florissant and Acosta in St. Bernard Parish, 3C Riverside in St. Charles Parish, Myrtle Grove in Plaquemines Parish, and Pearlington Dirt Phase 2 in Hancock County, Mississippi. The quantity of borrow material available from each site was not provided in IER #23. As of July 2011, the following borrow sites were utilized for the HSDRRS construction: Acosta, 3C Riverside, and Pearlington Dirt Phase 2.

2.3.5 Individual Environmental Report #25

Under IER #25, the USACE analyzed four borrow areas located in Orleans, Jefferson, and Plaquemines parishes for use under the government-furnished borrow material program to supply levee building material to the HSDRRS. Borrow areas investigated in this IER potentially provided approximately 9 million cy of suitable material for the HSDRRS levee and floodwall projects. The Proposed Action consisted of potentially excavating all suitable material from the following four borrow areas: Stumpf in Orleans Parish, Westbank D and Westbank E in Jefferson Parish, and Tac Carrere in Plaquemines Parish. The quantity of borrow material available from each site was not provided in IER #25. None of the borrow sites have been used for the HSDRRS as of July 2011, and sites Westbank D and Westbank E will likely not be used in the future.

2.3.6 Individual Environmental Report #26

Five potential borrow sites were analyzed in IER #26 for use under the contractor-furnished borrow areas program to supply levee building material to the HSDRRS located in Jefferson, Plaquemines, and St. John the Baptist parishes, Louisiana, and Hancock County, Mississippi. Borrow areas investigated in this IER potentially provided approximately 11 million cy of suitable material for the HSDRRS projects. The IER #26 Proposed Action consisted of potentially removing all suitable material from the following five borrow areas: South Kenner and Willswood in Jefferson Parish, Meyer in Plaquemines Parish, Willow Bend in St. John the Baptist Parish, and Frierson in Hancock County, Mississippi. The quantity of borrow material available from each site was not provided in IER #26. As of July 2011, three of the five borrow sites have been used for the HSDRRS construction.

2.3.7 Individual Environmental Report #28

The HSDRRS action described in IER #28 under the government-furnished borrow program would utilize two borrow sites and an access corridor (for a site evaluated in IER #22) to supply levee building material to the HSDRRS. The borrow areas are located in Jefferson, Plaquemines, and St. Bernard parishes. The proposed borrow project consists of potentially removing all suitable material from the following borrow areas: Bazile in Plaquemines Parish, Johnson/Crovetto in St. Bernard Parish, and Westbank F access corridor in Jefferson Parish. The quantity of borrow material available from each site was not provided in IER #28. No borrow sites detailed in IER #28 were utilized for HSDRRS construction as of July 2011.

2.3.8 Individual Environmental Report #29

Three borrow sites were analyzed in IER #29 for use under the contractor-furnished borrow areas program to supply levee building material to the HSDRRS located in Orleans, St. John the Baptist, and St. Tammany parishes. The Proposed Action consisted of potentially excavating all suitable material from the following three borrow areas: Eastover Phase II in Orleans Parish, Tammany Holding in St. Tammany Parish, and Willow Bend Phase II in St. John the Baptist Parish. The quantity of borrow material available from each site was not provided in IER #29. As of July 2011, all of the borrow sites were used for the HSDRRS construction.

2.3.9 Individual Environmental Report #30

Three borrow sites were identified in IER #30 for use under the contractor-furnished borrow areas program to supply the HSDRRS levee building material. The borrow sites are located in St. Bernard and St. James parishes, Louisiana, and Hancock County, Mississippi. The Proposed Action consisted of potentially excavating all suitable material from the following three borrow areas: Big Shake in St. James Parish, Contreras Dirt (Cells E, F, and Z) in St. Bernard Parish, and Henley in Hancock County, Mississippi. The quantity of borrow material available from each site was not provided in IER #30. The HSDRRS construction, as of July 2011, has utilized only the Contreras Dirt borrow site.

2.3.10 Individual Environmental Report #31

A total of 10 borrow sites were analyzed in IER #31 for use under the contractor-furnished borrow areas program to supply levee building material for the HSDRRS. The borrow sites are located in East Baton Rouge, Jefferson, Lafourche, Plaquemines, St. Bernard, and St. Tammany parishes, Louisiana, and Hancock County, Mississippi. The Proposed Action consisted of potentially removing all suitable material from the following borrow areas: Acosta 2 and Spoil Area in St. Bernard Parish, Idlewild Stage 2 and Scarsdale in Plaquemines Parish, Levis in St. Tammany Parish, Lilly Bayou in East Baton Rouge Parish, Raceland Raw Sugars in Lafourche Parish, River Birch Landfill Expansion in Jefferson Parish, Louisiana, and Port Bienville and King Mine in Hancock County, Mississippi. The quantity of borrow material available from each site was not provided in IER #31. As of July 2011, the following borrow sites were used for the HSDRRS construction: Acosta 2, Port Bienville, and River Birch Landfill Expansion.

2.3.11 Individual Environmental Report #32

Under IER #32, seven borrow sites were analyzed for use under the contractor-furnished borrow areas program to supply levee building material for the HSDRRS. The sites are primarily located in Plaquemines Parish, with one site each in Ascension and St. Charles parishes. The Proposed Action consisted of potentially removing all suitable material from the following seven borrow areas: Bocage in Ascension Parish; Citrus Lands, Conoco Phillips, Idlewild Stage 1, Nairn and Plaquemines Dirt and Clay in Plaquemines Parish; and 3C Riverside Phase 3 in St. Charles Parish. The quantity of borrow material available from each site was not provided in IER #32. As of July 2011, the following borrow sites were utilized for the HSDRRS construction: Idlewild Stage 1, Plaquemines Dirt and Clay, and 3C Riverside Phase 3.

A total of 37 of the proposed borrow sites are not located in the HSDRRS project area (table 2-10).

Table 2-10. Borrow Sites Outside of the HSDRRS Sub-basin Project Area Sorted by Parish/County

IER #	Type of Borrow	Site Name	Parish/County	Status as of July 2011
32	CF	Bocage	Ascension	not utilized
31	CF	Lilly Bayou	East Baton Rouge	not utilized
19	CF	St. Gabriel Redevelopment	Iberville	not utilized
31	CF	Raceland Raw Sugar	Lafourche	not utilized
18	GF	Triumph	Plaquemines	not utilized
19	CF	Kimble #2	Plaquemines	not utilized
22	GF	Brad Buras	Plaquemines	not utilized
22	GF	Tabony	Plaquemines	not utilized
23	CF	Myrtle Grove	Plaquemines	not utilized
25	GF	Tac Carrere	Plaquemines	not utilized
26	CF	Meyer	Plaquemines	not utilized

Table 2-10, continued

IER #	Type of Borrow	Site Name	Parish/County	Status as of July 2011
28	GF	Bazile	Plaquemines	not utilized
31	CF	Idlewild Stage 2	Plaquemines	not utilized
31	CF	Scarsdale	Plaquemines	not utilized
32	CF	Citrus Lands	Plaquemines	not utilized
32	CF	Conoco Phillips	Plaquemines	not utilized
32	CF	Idlewild Stage 1	Plaquemines	utilized for construction
32	CF	Nairn	Plaquemines	not utilized
32	CF	Plaquemines Dirt & Clay	Plaquemines	not utilized
18	GF	4001 Florissant	St. Bernard	not utilized
23	CF	1025 Florissant	St. Bernard	not utilized
23	CF	Acosta	St. Bernard	utilized for construction
31	CF	Acosta 2	St. Bernard	utilized for construction
18	GF	Bonnet Carré Spillway (North)	St. Charles	utilized for construction
23	CF	3C Riverside (Site 1 and 2)	St. Charles	utilized for construction
32	CF	3C Riverside Phase 3	St. Charles	utilized for construction
30	CF	Big Shake	St. James	not utilized
26	CF	Willow Bend	St. John the Baptist	utilized for construction
29	CF	Willow Bend Phase II	St. John the Baptist	utilized for construction
29	CF	Tammany Holding Area	St. Tammany	utilized for construction
31	CF	Levis	St. Tammany	not utilized
19	CF	Pearlington Dirt Phase 1	Hancock	utilized for construction
23	CF	Pearlington Dirt Phase 2	Hancock	utilized for construction
26	CF	Frierson	Hancock	utilized for construction
30	CF	Henley	Hancock	not utilized
31	CF	Port Bienville	Hancock	utilized for construction
31	CF	King Mine	Hancock	not utilized

GF=government-furnished; CF=contractor-furnished

2.4 HSDRRS MITIGATION COMPONENTS

Although impacts on sensitive resources were avoided to the greatest extent practicable in the HSDRRS area, some impacts were unavoidable. If avoidance is not possible, impacts were minimized to the greatest extent possible. Some impacts that cannot be avoided or minimized, are required to be mitigated (WRDA 1986, and Section 2036 of WRDA 2007). USACE endeavors to:

- first avoid the impact,
- if avoidance is not possible, then minimize the impact,
- reduce or eliminate the impact, or
- compensate for unavoidable impacts.

The term “mitigation” is often used in discussing methods implemented to reduce the level of a variety of adverse impacts; it is also used when specifically discussing the reduction of impacts on wetlands and non-jurisdictional BLH. However, other natural (e.g., nesting birds), physical (e.g., temporary road closures), and human (e.g., increased construction noise) resources have been impacted by the construction of the HSDRRS, and are also part of the mitigation process commitments for the reduction or elimination of HSDRRS impacts, to the maximum extent practicable. For further clarification, some mitigation measures are denoted in the IERs as environmental design commitments (EDC). Although all EDC defined in the IERs were indeed

mitigation efforts, the *Wetlands and Non-Jurisdictional Bottomland Hardwoods Mitigation IERs* (IERs #36 and #37) only address the mitigation as it applies to wetlands (jurisdictional BLH, swamp, and marsh) and non-jurisdictional BLH.

IERs #36 and #37 are being prepared to describe mitigation for HSDRRS impacts on wetlands and non-jurisdictional BLH. Mitigation efforts have been ongoing through the HSDRRS effort and include avoidance, reduction and minimization, and compensation efforts, for natural habitats. For example, as mentioned previously, all impacts on jurisdictional wetlands were avoided during the use of borrow sites because one of the selection criteria for choosing suitable borrow sites required that borrow material could be removed without directly impacting wetlands. Where contractor-furnished borrow sites impacted non-jurisdictional BLH, these impacts were mitigated in advance by contractors through the purchase of credits at mitigation banks. As of September 2011, impacts on approximately 117.15 acres (65.97 AAHUs) of non-jurisdictional BLH forest were mitigated in association with the HSDRRS excavation of contractor-furnished borrow areas.

Throughout the CED, the mitigation IERs (#36 and #37) are collectively referred to as *Wetlands and Non-Jurisdictional Bottomland Hardwoods Mitigation IERs*. Section 5.0 discusses all mitigation processes associated with HSDRRS, including the Mitigation Program. Where applicable throughout the CED, the term “compensatory mitigation” will be used for mitigation to wetlands and non-jurisdictional BLH.

The USACE has partnered with Federal and state resource agencies to form an interagency mitigation team that is working to assess and verify impacts and to investigate potential mitigation sites in the appropriate hydrologic basin. This effort is occurring concurrently with the IER environmental planning process in an effort to complete mitigation work and construct mitigation projects expeditiously. As with the planning process for all IERs, the public will have the opportunity to give input during a 30-day public review and comment period about the Proposed Actions described by the *Wetlands and Non-Jurisdictional Bottomland Hardwoods Mitigation IERs*. The current timeline and the anticipated dates for completion of the *Wetlands and Non-Jurisdictional Bottomland Hardwoods Mitigation IERs* are as follows:

- Initiated mitigation study (completed May 2010)
- Held five scoping meetings (completed May 2010)
- Initial screening of mitigation measures (September 2010)
- Two project status public meetings (completed December 2010)
- Completed alternative evaluation process (AEP) (completed November 2011)
- Determine Tentatively Selected Plan (TSP) (July 2012)
- Release of the programmatic mitigation IERs (May 2013)

Mitigation for impacts on open water habitats and the use of Wetland Value Assessment (WVA) models to evaluate such impacts will follow guidelines developed cooperatively between CEMVN, NMFS, and USFWS (see appendix S). Those guidelines are undergoing further refinement. The USACE anticipates completion of the guidelines prior to the release of any supplement(s) to the CED, and the final version of these guidelines will be included, as appropriate, in forthcoming NEPA documents. In general, mitigation for impacts on open water habitats would typically be limited to any fill that would permanently affect open water habitats classified as EFH or containing SAV; any excavation impact on open water habitats containing SAV or designated as EFH where excavation would create permanent anoxic conditions in the affected area; any fill or excavation impact on open water habitats containing SAV species which include seagrasses; or any fill or excavation in open water habitat that is designated as oyster seed grounds by LDWF. However, mitigation for impacts on open water habitats would not typically be required for dredging in open water areas where no SAV is present (even if the affected area is designated as EFH), for filling of an open water area such that the area would not

be converted to non-aquatic habitat, or where the impact on open water habitats would be less than 1 acre within a single open water area. Interspersed open water areas within and adjacent to marsh areas were assessed along with marsh impacts using the WVA methodology. The wetlands and non-jurisdictional BLH mitigation process was included for lost functions of those aquatic habitats.

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SECTION 3.0
PRESENT AND FUTURE REGIONAL PROJECTS AND PROGRAMS

3.0 PRESENT AND FUTURE REGIONAL PROJECTS AND PROGRAMS

Since the 2005 hurricane season, significant resources and efforts have focused on southeast Louisiana. Rebuilding efforts are taking place throughout the Gulf Coast in Louisiana, Mississippi, and Alabama.

The Insurance Information Institute (2007) has estimated that insured losses from Hurricane Katrina totaled \$40.6 billion in six states. In Louisiana, insured losses were estimated at nearly \$26 billion. Since Hurricanes Katrina and Rita, the Greater New Orleans Metropolitan Area has experienced a tremendous amount of reconstruction (photograph 3-1).

Although it is unknown how many structures (private, public, residential, and commercial) will be rebuilt within the entire HSDRRS project area, a large-scale rebuilding effort is under way. In Orleans Parish alone, from August 2005 until July 2011, 343,220 building permit applications have been submitted for residential and commercial storm damage reconstruction, repair, demolition, and new building (see Storm Damage Reconstruction in appendix L). FEMA is providing funding to various public agencies within the five-parish HSDRRS area for rebuilding efforts, including funding for street repairs to 6,000 city blocks within Orleans Parish, sidewalk repairs, repairs to damaged sewer and potable water infrastructure, and repairs to or replacement of public buildings. In addition, many other Federal, state, local, and non-profit organizations have come to the aid of the Gulf Coast region. Many projects have been, and are currently being, initiated by the USACE, other Federal, state, and local agencies, research institutes, and individuals. As part of determining the projects proposed since the 2005 hurricane season, CEMVN regulatory permits in the HSDRRS area for the years 2007 through June 2011 were also evaluated. Although some of the proposed projects have not yet been implemented, many of these projects are ongoing within southeast Louisiana.



Photograph 3-1. Regional projects depicting storm damage reconstruction and coastal restoration.

Appendix L provides a listing of the proposed or ongoing projects within the region and forms the basis for analyzing the impacts of other present and future actions on each resource (see section 4.0). For organizational purposes, the projects found in appendix L are sub-categorized by the following:

- Storm Damage Reconstruction
- Redevelopment
- Coastal and Wetlands Restoration
- Flood Risk Reduction Projects
- Transportation

The list of regional projects in appendix L was used to develop the HSDRRS cumulative impacts analysis. The list of projects was developed by reviewing local, state, and Federal websites for projects that are ongoing and in the planning stages within the region. Additionally, local, Federal, and state agencies were contacted to gather as much information about a project as possible. While the list in appendix L does not describe every project within the region, it does illustrate the extensive nature of the rebuilding and new construction efforts in the area.

3.1 FLOOD RISK REDUCTION PROJECTS IN LOUISIANA

A summary of the major flood risk reduction projects in the region is included below. These projects are illustrated in figure 3-1.

3.1.1 New Orleans to Venice (NOV), Louisiana Hurricane Protection

The project was initially authorized in the Flood Control Act of 1962. Prior to Hurricane Katrina in 2005, the NOV project was approximately 85 percent complete, with an estimated completion date of 2018 (figure 3-2). Since the 2005 hurricane season, the USACE has repaired the damage caused by Hurricane Katrina. The project straddles the Mississippi River in Plaquemines Parish. On the east bank, the project extends 16 miles on the back levee from Phoenix to Bohemia, Louisiana. On the west bank, a non-Federal levee extends 34 miles from St. Jude to Venice on the back levee and on the mainline levee. In the aftermath of the 2005 hurricane season, restoration and accelerated completion of the NOV project, as well as incorporation of certain non-Federal levees into NOV, were authorized and funded at \$769 million in the 3rd, 4th, 6th, and 7th supplementals passed by Congress. A Supplemental EIS for the NOV project entitled *Supplemental Environmental Impact Statement New Orleans to Venice Federal Hurricane Protection Levee Plaquemines Parish, Louisiana* was provided for public review and comment in Spring and Summer 2011, and the Record of Decision (ROD) was signed on October 31, 2011.

The design evaluated in the Supplemental EIS and ROD would increase the elevation of all Federal flood risk reduction structures to meet the 50-year risk reduction design grade, and would stabilize those sections of levees where subsoil deficiencies or internal levee deficiencies undermine their strength. The 50-year level of risk reduction means to reduce the risk from a storm surge that has a 2 percent chance of being equaled or exceeded in any given year. Upon completion, the project will achieve storm risk reduction for Plaquemines Parish at the authorized (2 percent) level. In most levee sections, this would involve elevating the levee crest with earthen fill and expanding the levee base footprint to provide the necessary design strength. The addition of earthen fill and expansion of the levee base would be the most likely method to stabilize subsoil sections of levees requiring additional strength. Concrete T-walls would be repaired or replaced on the top of some levees where design and cost factors dictate. Existing pump station walls and floodgates would also be restored and armored to meet the authorized design criteria. This project is scheduled for completion in 2015.

3.1.2 Plaquemines Parish Non-Federal Levee

This proposed project includes replacing or modifying certain non-Federal levees on the west bank of the Mississippi River for incorporation into the NOV Federal Levee project, described in section 3.1.1. An EIS entitled *New Orleans to Venice, Louisiana, Hurricane Risk Reduction Project: Incorporation of Non-Federal Levees from Oakville to St. Jude Plaquemines Parish, Louisiana* was released for public review and comment in Spring and Summer 2011, and the ROD was signed on October 31, 2011. In the EIS, several levee alignments were investigated to reduce risks to communities, businesses, and the hurricane evacuation route, and to avoid wetland impacts.

3.1.3 Larose to Golden Meadow, Louisiana, Hurricane Protection Project

This existing project consists of a ring levee approximately 40 miles in length protecting the areas along the east and west banks of Bayou Lafourche, extending from Larose to just south of Golden Meadow (figure 3-3). Floodwalls are constructed in areas where the congested nature of improvements and limited ROW prevented the construction of levees. The project provides for the construction of navigable floodgates on Bayou Lafourche at the upper and lower limits of the project area. In lieu of the eight gravity drainage structures that were authorized as part of the project, the non-Federal sponsor would pay the additional cost for construction of pump stations.



Figure 3-1: Major Flood Risk Reduction Projects in Louisiana

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Figure 3-2: NOV Project Area

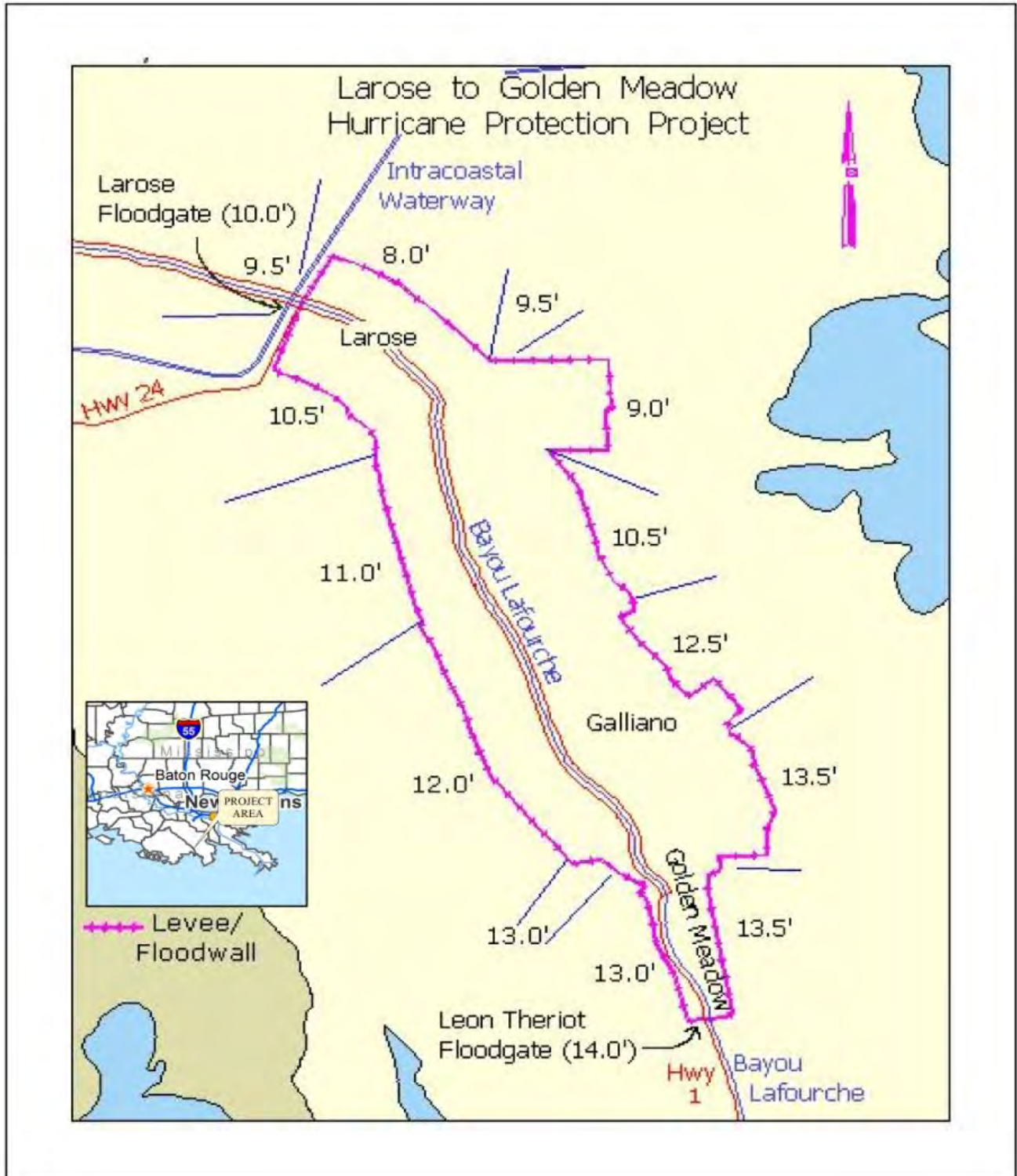


Figure 3-3. Larose to Golden Meadow Project

The Leon Theriot Floodgate is a component of the Larose to Golden Meadow Hurricane Protection project. The purpose of the floodgate is to provide for navigation on Bayou Lafourche and prevent tidal flooding within the project area. Construction of the floodgate was completed in 1985; however, it is currently being converted into a lock because of increased floodgate closures resulting from sea-level rise, subsidence, and storms. Further, there has been an increase in vessel traffic since authorization of the original project (USACE 2004a). The Leon Theriot Lock was authorized in August 2005 and was completed in mid-2009 (South Lafourche Levee District 2008). State surplus funds were utilized for the construction of the Leon Theriot Lock. Levees are being completed based on original design conditions using the original benchmarks and risk reduction level. Currently, the South Lafourche Levee District is in the process of independently constructing levee lifts to account for the outdated benchmarks and changing environmental conditions.

Because of subsidence and sea-level rise, the completed project cannot provide the same level of risk reduction as current USACE design criteria; therefore, additional levee lifts will be needed. As the project is not currently at the authorized elevation, any additional investment in the system would reduce the risk of flood and storm damage to residences, businesses, and other infrastructure. WRDA 2007, Section 7015 requested that USACE provide Congress with a report describing the improvements and modifications necessary for raising the system to a 1 percent probability storm protection level. The USACE completed its report in late Fiscal Year (FY) 2008 and identified the obstacles to construction of the system to the new 100-year level of risk reduction, including projected costs. The reported improvements and modifications greatly exceeded the \$90 million cap over which modifications were authorized by Section 7015, should those modifications also have been feasible.

Based on preliminary analysis, it appears that there is a continued Federal interest, and feasibility should be assessed to determine what level of risk reduction is appropriate. Furthermore, due to the magnitude of the increase in cost and the need for detailed field data to refine the designs, a Post-Authorization Change Study is recommended in the WRDA of 2007, Section 7015, Report to Congress. A Draft Post Authorization Change Study is scheduled to be completed in December 2012.

3.1.4 Morganza to the Gulf of Mexico Risk Reduction Project

In March 2002, a feasibility report and Programmatic EIS entitled *Mississippi River & Tributaries - Morganza, Louisiana to the Gulf of Mexico Hurricane Protection* was prepared by the USACE. There is an Addendum 1 to the report dated April 2003 and an Addendum 2 dated March 2004. The Chief's Report (which the proposed authorizing language references) is dated August 9, 2002. The Chief's Report was also supplemented in 2003 (USACE 2008d).

The recommended plan proposes a series of flood risk reduction measures and includes the following:

- The construction of approximately 72 miles of levee south of Houma.
- The construction of ten 56 ft wide sector gate structures, three 125 ft wide sector gate structures, and 13 tidal exchange structures.
- The construction of a lock structure and floodgate complex for the Houma Navigation Canal (HNC).

The area to be protected by the levee system is a former major delta lobe from a previous course of the Mississippi River. As in other locations in south Louisiana, urban and agricultural development has occurred along the banks of the remnant ridges within the former delta lobe. The GIWW is linked to the Atchafalaya Basin and conveys water eastward to the

area. The Houma Navigation Canal intercepts these flows before they reach the area of need and conveys them efficiently to the Gulf of Mexico (figure 3-4). With the levee system and water control structures in place, the Atchafalaya River flows can be managed and distributed across the area. The proposed Morganza to the Gulf levees and water control structures would convey Atchafalaya River water eastward and would support the efforts proposed within the Louisiana Coastal Area Program (LCA) Plan, thus helping to solve the saltwater intrusion problem in the Houma area.

The Morganza to the Gulf project was authorized to provide 100-year level of hurricane and storm damage risk reduction based on feasibility reports and Reports of the Chief of Engineers in 2002 and 2003, prior to development and implementation of post-Katrina design criteria. In the interest of public safety, and to be consistent with design policy established for the Greater New Orleans Metropolitan Area, the USACE will incorporate lessons learned from Hurricanes Katrina and Rita into the designs for the Morganza to the Gulf project.

The cost to incorporate post-Katrina design criteria into the Morganza project will exceed the authorized project cost by more than 20 percent, thereby exceeding the Section 902 Limit (WRDA of 1986) and triggering the need for reauthorization by Congress. A Post Authorization Change Report is currently being developed to seek reauthorization.

The Terrebonne Levee and Conservation District is working toward construction of some first-lift levees along the authorized alignment in advance of the Federal project through the regular permit process. A 50 percent design was complete on the HNC Lock Complex in July 2008. Further design is on hold pending confirmation of a Federal interest in the Post Authorization Change Report and additional funding. A Revised Programmatic EIS will be prepared for concurrent submittal with the Post Authorization Change Report. This document will evaluate changes in existing conditions and evaluate all direct and indirect environmental impacts of increased levee footprints resulting from the post-Katrina design criteria. The Revised Programmatic EIS will include sufficient detail for any features that can be constructed (i.e., HNC Lock complex) so that no additional environmental clearances will be required for those features upon signing of the ROD. The Post Authorization Change Report and Revised Programmatic EIS are scheduled for completion in 2013.

3.1.5 Grand Isle and Vicinity Hurricane Protection Projects

The Grand Isle Beach Erosion and Hurricane Protection Project was authorized by resolutions of the House of Representatives and the Senate dated September 23, 1976 and October 1, 1976, respectively, under Section 201 of the Flood Control Act of 1965 dated October, 27 1965 (Public Law (P L) 89-298, House Document No. 94-639). The project is located on the coast of the Gulf of Mexico in southern Jefferson Parish, about 50 miles south of New Orleans and 45 miles northwest of the mouth of the Mississippi River. Over the years, numerous projects have been proposed and constructed at Grand Isle. In the 1970s, the State of Louisiana

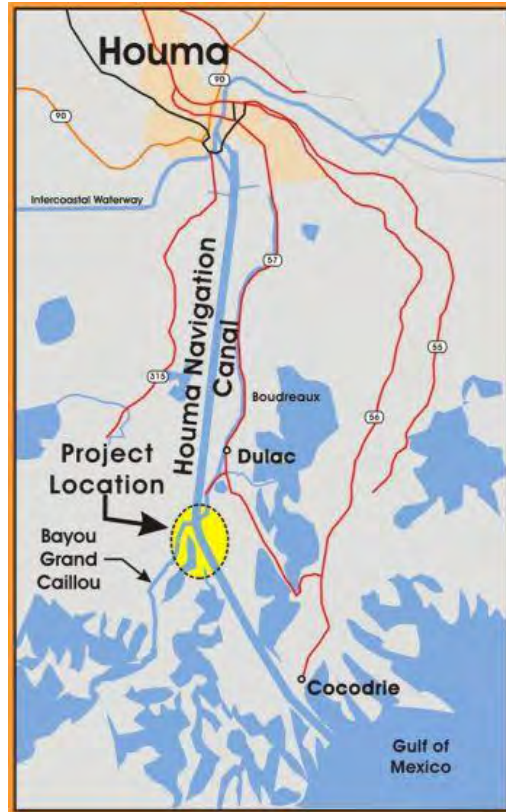


Figure 3-4. Location of Houma Navigation Canal Lock and Floodgate Complex.

constructed a 2,600 ft long stone jetty on western Grand Isle and a sand-filled dune and berm along the shore; both were incorporated into the Federal project. The State also constructed a jetty at the east end of the island in 1964; however, it was never incorporated into the Federal project.

By 1985, the Grand Isle Beach Erosion and Hurricane Protection Project was essentially complete (USACE 1985, 1986). However, Hurricanes Danny, Elena, and Juan struck Grand Isle in 1985, and from 1985 to 1989 the USACE went through several iterations of designs to repair the project. A cusped bar was dredged and used to restore the beach and dune at the state park. A breakwater consisting of two small areas of biodegradable sand-filled bags was built. The west end jetty was extended 500 feet, and the east end jetty (which is not part of the authorized project) was extended 200 feet. In 1989, the Town of Grand Isle built a stabilization complex consisting of two groins, a seawall, and four segmented offshore breakwaters (USACE 1989a, 1989b). In 1991, additional nourishment of the beach and dune repair was completed. Following Hurricane Andrew in 1992, an evaluation of breakwaters was implemented in order to reduce the erosion rate back to the levels predicted during the original Hurricane Protection Project design. Between December 1994 and May 1995, 23 breakwater segments were constructed. Prior to the fall of 2008, there was an ongoing construction project to repair damages to the Federal dune project caused by Hurricane Katrina. After Hurricane Gustav in 2008, the USACE conducted emergency repairs along an approximately 8,000 linear ft reach on the western end of the island on the Gulf-side levee. In 2009, the USACE completed additional rehabilitation of the Grand Isle and Vicinity project with rehabilitation of approximately 5.7 miles of the sand-covered berm along the entire Gulf-side beach by constructing geo-textile tubes and then covering those with sand (photograph 3-2). In 2010, the USACE performed additional repairs on the west-end jetty. The 2008, 2009, and 2010 work was performed in response to damage caused by Hurricane Gustav and Hurricane Ike. The work performed in 2009 and 2010 was funded by FY 2009, Continuing Resolution Authority, 7th Supplemental funding.



Photograph 3-2. Initial placement of geo-textile tubes.

3.1.6 Mississippi River Gulf Outlet Deauthorization

The Mississippi River-Gulf Outlet (MRGO) was authorized by a March 29, 1956 Act of Congress (P L 84-455) to provide an emergency outlet from the Mississippi River and as a safer and shorter route between the Port of New Orleans and the Gulf of Mexico. Construction began in 1958 and was completed in 1968. When constructed, the MRGO provided a 66-mile, 40 ft deep draft navigation access from the Gulf of Mexico to the New Orleans port area, which is located along the upper reaches of the MRGO and the IHNC, close to the junction of the GIWW and the Mississippi River (figure 3-5). Since that time, the surface dimensions of the channel have increased beyond those of the original construction, and in some areas, the width of the channel has appreciably widened as a result of erosion. The authorized channel width for the project was 500 ft but, due to erosion, the channel is more than 2,000 ft wide at some locations.

In 1976, the USACE completed a document entitled, *Final Composite Environmental Statement for Operation and Maintenance Work on Three Navigation Projects in the Lake Borgne Vicinity Louisiana, The Mississippi River-Gulf Outlet, Bayous La Loutre, St. Malo, and Yscloskey Bayou Dupre* (USACE 1976).



Figure 3-5: Mississippi River Gulf Outlet in Southeast Louisiana

In 2006, the U.S. Congress directed the Secretary of the Army, acting through the Chief of Engineers, to develop a plan for de-authorization of deep-draft navigation for the MRGO from the Gulf of Mexico to GIWW. The Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (P L 109-234), reads in part:

“...the Secretary of the Army, acting through the Chief of Engineers, utilizing \$3,300,000 of the funds provided herein shall develop a comprehensive plan, at full Federal expense, to de-authorize deep-draft navigation on the Mississippi River-Gulf Outlet, Louisiana, extending from the Gulf of Mexico to the Gulf Intracoastal Waterway: Provided further, That, not later than 6 months after the date of enactment of this Act, the Secretary shall submit an interim report to Congress comprising the plan: Provided further, That the Secretary shall refine the plan, if necessary, to be fully consistent, integrated, and included in the final report to be issued in December 2007 for the Louisiana Coastal Protection and Restoration Plan.”

House Report 109-494 provides a Congressional conference committee manager’s statement accompanying the legislative language further directing that:

“The plan shall include recommended modifications to the existing authorized current use of the Outlet, including what navigation functions, if any, should be maintained and any measures for hurricane and storm protection. The plan shall be developed in consultation with St. Bernard Parish, the State of Louisiana, and affected Federal Agencies.”

In a December 2006 Interim Report, eight alternatives were developed that would allow continued shallow-draft navigation, four that completely closed the MRGO from the GIWW to the Gulf of Mexico, and one that would cease all navigation maintenance activities on the MRGO from the GIWW to the Gulf of Mexico (USACE 2008I).

On June 5, 2008, the Assistant Secretary of the Army for Civil Works forwarded the *Integrated Final Report to Congress and Legislative Environmental Impact Statement for the Mississippi River–Gulf Outlet Deep-Draft De-authorization Study* to Congress. This action officially de-authorized the MRGO from the GIWW to the Gulf of Mexico in accordance with the WRDA of 2007. The report can be found at <http://mrgo.usace.army.mil/>. The portion of the MRGO channel from mile 60 at the southern bank of the GIWW to the Gulf of Mexico was de-authorized for all navigation use. As part of the plan, a total closure structure was built of rock south of the Bayou La Loutre ridge in St. Bernard Parish, Louisiana in July 2009 (USACE 2008I). However, approximately 6 miles of the MRGO channel (from miles 66 to 60, that connect the IHNC to the GIWW), the Michoud Canal Project, and the IHNC Lock Replacement Project remain authorized.

A *MRGO Ecosystem Restoration Plan* was designed and prepared as a follow-up to the USACE’s implementation of the MRGO closure, as per the 2008 de-authorization plan. Currently the USACE has conducted a feasibility study that will result in a comprehensive ecosystem restoration plan to restore the Lake Borgne ecosystem and areas affected by the MRGO channel. This restoration plan is being developed in accordance with Section 7013 of the WRDA of 2007. The feasibility study is fully funded by the Federal government. The purpose of the study is to address systematic ecosystem restoration with consideration of measures to reduce or prevent damages from storm surge. Features outlined in the plan include marsh created using dredged material, cypress trees and other wetlands vegetation plantings, shoreline protection with breakwaters, creating oyster reefs, and freshwater diversions from the Mississippi River near the community of Violet, Louisiana, to reduce salinity and enhance wetlands and fishery productivity (USACE 2011g). The plan also includes proposed public access recreation features in Shell Beach, Meraux, and the Lower 9th Ward. The *MRGO Ecosystem Restoration Plan Draft Feasibility Report and Environmental Impact Statement*

(USACE 2010a, 2011e) was made available for final State and agency 30-day review on July 27, 2012, and extended an extra 10 days to end on September 6, 2012 (USACE 2012a).

3.1.7 Inner Harbor Navigation Canal (IHNC) Lock Replacement Project

The current IHNC lock, built in 1921, is 640 ft long, 75 ft wide, and 31.5 ft deep and connects the Mississippi River with the IHNC, GIWW, and MRGO (photograph 3-3). The current lock is too small to accommodate modern vessels. The project was authorized by a March 29, 1956 Act of Congress (P L 84-455), and was amended by Section 186 of the WRDA of 1976 (P L 94-587). Eight potential sites for a new lock were evaluated through planning



Photograph 3-3. The IHNC looking south-southwest.

efforts and public involvement beginning as early as 1960. WRDA of 1986 (P L 99-662) modified the project to locate the new lock at either the existing lock site or at the Violet site, and modified the project's cost-sharing agreement. The USACE proposed a replacement lock project in 1997 that is documented in *The Final Environmental Impact Statement for the Mississippi River – Gulf Outlet New Lock and Connecting Channels* (USACE 1997). The 1997 EIS evaluated two action plans in detail. In 2006, the Federal District Court, Eastern New Orleans District, enjoined the project and required the preparation of a Supplemental EIS to describe changes in existing conditions after Hurricane Katrina and to analyze impacts from the recommended plan and alternatives on current conditions. The plan was revised and a new supplemental NEPA document was prepared entitled *The Final Supplemental Environmental Impact Statement for the Inner Harbor Navigation Canal Lock Replacement Project* (USACE 2009u). The ROD for this Supplemental EIS was signed on May 20, 2009.

The planned replacement lock would provide a nearly three-fold increase in lock chamber capacity, easing transport through this high-traffic waterway. Based upon an analysis of impacts and costs of the alternative plans at the North of Claiborne IHNC Lock Site, the Float-in-place Plan was determined to be the new recommended plan. Although this plan is, for the most part, the same as the plan recommended in the 1997 EIS, additional evaluation on the location and design of the confined disposal facility, as well as the method for disposal of contaminated sediments, were addressed in this document. Overall, the Float-in-place Plan would have less construction-related impacts on the community than the Cast-in-place Plan. Although project modifications were made to minimize socioeconomic and noise impacts and alterations to traffic patterns during the lock and bridge construction, short-term adverse impacts are anticipated to occur on housing, business and industrial activity, community services, tax revenues, and vehicle transportation. Additionally, long-term adverse impacts would occur on aesthetics and recreational resources from the IHNC Lock replacement project due to the modification of levees and floodwalls.

On September 9, 2011, the USACE was ordered by a Federal judge in New Orleans to halt work on the IHNC Lock Replacement project until the USACE drafts a second supplemental EIS addressing the effects of closing the MRGO on the plan. The U.S. District Judge

determined that the USACE failed to adequately consider how the closure of the MRGO may have affected the need for the lock to be deep enough to handle deep-draft vessels.

3.1.8 Southeast Louisiana Urban Flood Control Project (SELA)

The purpose of the project is to reduce damages due to rainfall flooding in Orleans, Jefferson, and St. Tammany parishes (figure 3-6). The project was authorized by the Fiscal 1996 Energy and Water Development Appropriations Act (Section 108) and the WRDA of 1996 (Section 533). Several NEPA documents, including EAs and Supplemental EAs, were prepared from 1996 to 2008 to identify work to be implemented under the SELA project authority.

Construction began in 1998 and portions of this project are ongoing, while other portions are still in the planning stages. The proposed work is located on both the east and west banks of the Mississippi River in Orleans and Jefferson parishes and north of Lake Pontchartrain. In Jefferson Parish, work is limited to the more densely populated northern portion, while in St. Tammany Parish work is located in and around the communities of Slidell, Mandeville, Lacombe, Covington, Abita Springs, and Madisonville.

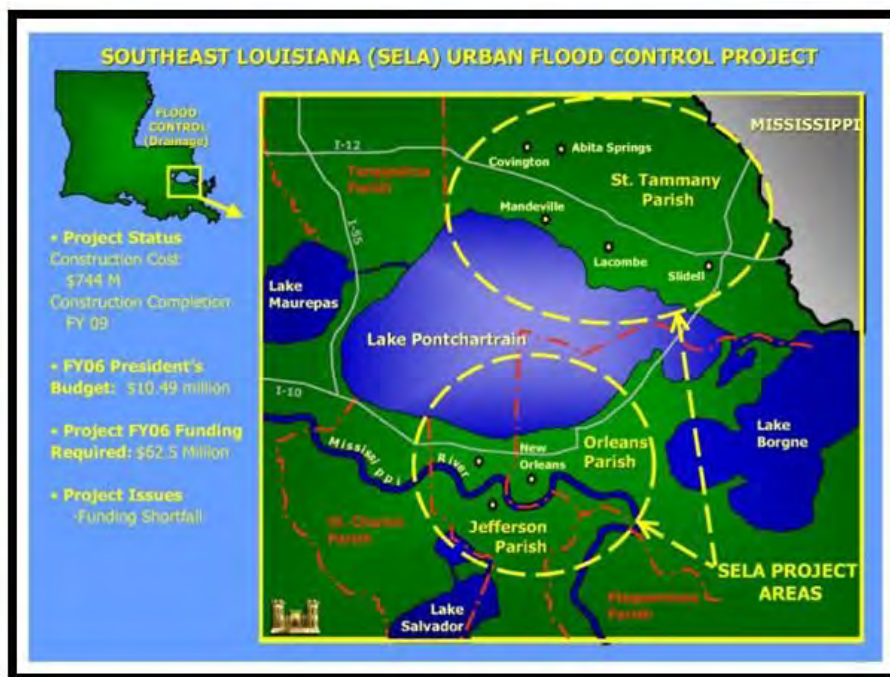


Figure 3-6. SELA Project Areas.

It is currently anticipated that 59 scheduled and funded construction contracts in Jefferson Parish and 20 scheduled and funded projects in Orleans Parish will be completed in 2017. In Orleans Parish, plans involve improving 12 major drainage lines, adding pumping capacity to one pump station, and constructing two new pump stations. In Jefferson Parish, plans include improvements to about 24 drainage canals, additional pumping capacity for four pump stations, and the construction of two new pump stations. A substantial amount of this work has been completed in Orleans and Jefferson parishes. The improvements support the parishes' master drainage plans and generally provide flood risk reduction on a level associated with a 10-year rainfall event, while also reducing damages for larger events. In Jefferson Parish, 50 contracts have been awarded to date, and 44 projects have been completed. In Orleans Parish, 13 contracts have been awarded, with 9 having been completed.

Planned improvements in St. Tammany Parish include channel enlargements, bridge replacements, detention ponds, levees, and elevation of flood-prone structures. St. Tammany

Parish plans would provide flood risk reduction for various rainfall events. The work is still unscheduled. The USACE is working with the parish administration to complete a study of the W-14 watershed in Slidell and to develop a plan for a parish-wide study.

3.1.9 Mississippi River Levees

The Flood Control Act of 1928 authorized work that would give the various Mississippi River basins protection from Mississippi River floods. The tributary streams within the basins also caused frequent flood damage that could not be prevented by the main stem Mississippi River protective works. Later authorizations to the Flood Control Act of 1928 added protective works to tributaries and created floodways that work to control river flooding within the Mississippi River basin.

The MRL system in the New Orleans District extends along the Mississippi River west bank from the vicinity of Black Hawk, Louisiana, generally southward to the vicinity of Venice, and on the east bank from Baton Rouge to Bohemia, Louisiana. The project is designed to provide risk reduction for a project flood having a flow of 3 million cfs at the latitude of Old River north of Baton Rouge. Floodways are provided at Morganza, the Atchafalaya Basin, and Bonnet Carré to remove waters in excess of the safe capacity of the main channel. The project is part of a system that includes features such as levees, floodwalls, floodgates, pumping stations, drainage structures, locks, and channel improvements. The MRL project is one of the main components for flood control on the Mississippi River.

3.1.10 Other LPV and WBV Prior Projects

Other prior pertinent studies, reports, and projects for the LPV and WBV risk reduction projects are discussed below.

3.1.10.1 LPV Risk Reduction Projects

- In June 2009, the USACE finalized an EA #475 evaluating the potential impacts associated with the proposed stormproofing modifications at 21 existing drainage pump stations in Jefferson Parish, Louisiana. The purpose of this project is to ensure the operability of the stations during hurricanes, storms, and high water events. The modifications were proposed for those Jefferson Parish pump stations on the east and west banks of the Mississippi River to ensure station operation during, and immediately following, large tropical storm events (USACE 2009m).
- In May 2009, the USACE finalized an EA #474 evaluating the potential impacts associated with the proposed stormproofing modifications at 22 Orleans Parish pump stations, the Carrollton Frequency Changer Building, the Old River Intake Station, the New River Intake Station, and the Carrollton Water Plant and Power Complex. The purpose of this project is to ensure the operability of the stations during hurricanes, storms, and high water events. The modifications were proposed for the east and west banks of urbanized areas of Orleans Parish to provide safe refuge for Orleans Parish employees responsible for the operation and maintenance of the forced drainage system during, and immediately following, large tropical storm events (USACE 2009r).
- In July 2006, the CEMVN Commander signed a Finding of No Significant Impact (FONSI) for EA #433 entitled *USACE Response to Hurricanes Katrina & Rita in Louisiana*. The document was prepared to evaluate the potential impacts associated with the actions taken by the USACE as a result of Hurricanes Katrina and Rita.
- On October 30, 1998, the CEMVN Commander signed a FONSI for EA #279 entitled *Lake Pontchartrain Lakefront, Breakwaters, Pump Stations 2 and 3*. The report evaluates the impacts associated with providing fronting protection for outfall canals

and pump stations. It was determined that the action would not significantly impact resources in the immediate area.

- On October 2, 1998, the CEMVN Commander signed a FONSI for EA #282 entitled *LPV, Jefferson Parish Lakefront Levee, Landside Runoff Control: Alternate Borrow*. The report investigates the impacts of obtaining borrow material from an urban area in Jefferson Parish. No significant impacts on resources in the immediate area were expected.
- On July 2, 1992, the CEMVN Commander signed a FONSI for EA #169 entitled *LPV, Hurricane Protection Project, East Jefferson Parish Levee System, Jefferson Parish, Louisiana, Gap Closure*. The report addresses the construction of a floodwall in Jefferson Parish to close a “gap” in the levee system. The area was previously leveed and under forced drainage, and it was determined that the action would not significantly impact the previously disturbed area.
- On February 22, 1991, the CEMVN Commander signed a FONSI for EA #164 entitled *LPV Hurricane Protection – Alternate Borrow Area for the St. Charles Parish Reach*. The report addresses the impacts associated with the use of borrow material from the Mississippi River on the left descending bank in front of the Bonnet Carré Spillway Forebay for LPV construction.
- On July 2, 1991, the CEMVN Commander signed a FONSI for EA #133 entitled *LPV Hurricane Protection – Alternate Borrow at Highway 433, Slidell, Louisiana*. The report addresses the impacts associated with the excavation of a borrow area in Slidell, for LPV construction.
- On August 30, 1990, the CEMVN Commander signed a FONSI for EA #163 entitled *LPV Hurricane Protection – Alternate Borrow Area for Jefferson Parish Lakefront Levee, Reach III*. The report addresses the impacts associated with the use of a borrow area in Jefferson Parish for LPV construction.
- On September 12, 1990, the CEMVN Commander signed a FONSI for EA #105 entitled *LPV Hurricane Protection – South Point to Gulf Intracoastal Waterway, A. V. Keeler and Company Alternative Borrow Site*. The report addresses the impacts associated with the excavation of a borrow area in Slidell, Louisiana, for LPV construction.
- On March 12, 1990, the CEMVN Commander signed a FONSI for EA #102 entitled *LPV Hurricane Protection – 17th Street Canal Hurricane Protection*. The report addresses the use of alternative methods of providing flood protection for the 17th Street Outfall Canal in association with LPV activity. Impacts on resources were found to be minimal.
- On August 4, 1989, the CEMVN Commander signed a FONSI for EA #89 entitled *LPV Hurricane Protection, High Level Plan - Alternate Borrow Site 1C-2B*. The report addresses the impacts associated with the excavation of a borrow area along Chef Menteur Highway, Orleans Parish, for LPV construction. The material was used in the construction of a levee west of the IHNC.
- On October 27, 1988, the CEMVN Commander signed a FONSI for EA #79 entitled *LPV Hurricane Protection – London Avenue Outfall Canal*. The report investigates the impacts of strengthening hurricane damage risk reduction at the existing London Avenue Outfall Canal.

- On July 21, 1988, the CEMVN Commander signed a FONSI for EA #76 entitled *LPV Hurricane Protection – Orleans Avenue Outfall Canal*. The report investigates the impacts of strengthening hurricane damage risk reduction at the existing Orleans Avenue Outfall Canal.
- On February 26, 1986, the CEMVN Commander signed a FONSI for EA #52 entitled *LPV Hurricane Protection – Geohegan Canal*. The report addresses the impacts associated with the excavation of borrow material from an extension of the Geohegan Canal for LPV construction.
- Supplemental Information Report (SIR) #25 entitled *LPV Hurricane Protection – Chalmette Area Plan, Alternate Borrow Area 1C-2A* was signed by the USACE on June 12, 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV construction.
- SIR #27 entitled *LPV Hurricane Protection – Alternate Borrow Site for Chalmette Area Plan* was signed by the USACE on June 12, 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV construction.
- SIR #28 entitled *LPV Hurricane Protection – Alternate Borrow Site, Mayfield Pit* was signed by the USACE on June 12, 1987. The report addresses the use of an alternate contractor-furnished borrow area for LPV construction.
- SIR #29 entitled *LPV Hurricane Protection – South Point to the GIWW Levee Enlargement* was signed by the USACE on June 12, 1987. The report discusses the impacts associated with the enlargement of the GIWW.
- SIR #30 entitled *LPV Hurricane Protection Project, Jefferson Lakefront Levee* was signed by the USACE on October 7, 1987. The report investigates impacts associated with changes in Jefferson Parish LPV levee design.
- SIR #17 entitled *LPV Hurricane Protection – New Orleans East Alternative Borrow, North of Chef Menteur Highway* was signed by the USACE on April 30, 1986. The report addresses the use of an alternate contractor-furnished borrow area for LPV construction.
- SIR #22 entitled *LPV Hurricane Protection – Use of 17th Street Pumping Station Material for LPHP Levee* was signed by the USACE on August 5, 1986. The report investigates the impacts of moving suitable borrow material from a levee at the 17th Street Canal in the construction of a stretch of levee from the IHNC to the London Avenue Canal.
- SIR #10 entitled *LPV Hurricane Protection, Bonnet Carré Spillway Borrow* was signed by the USACE on September 3, 1985. The report evaluated the impacts associated with using the Bonnet Carré Spillway as a borrow source for LPV construction and found “no significant adverse effect on the human and natural environment.”
- In December 1984, an SIR to complement the Supplement to the final EIS on the LPV Hurricane Protection project was filed with USEPA.
- The final EIS for the LPV Hurricane Protection Project, dated August 1974, was prepared. A Statement of Findings was signed by the USACE on December 2, 1974. Final Supplement I to the EIS, dated July 1984, was followed by a ROD, signed by the

USACE on February 7, 1985. Final Supplement II to the EIS, dated August 1994, was followed by a ROD signed by the USACE on November 3, 1994.

- A report entitled *Flood Control, Mississippi River and Tributaries*, published as House Document No. 90, 70th Congress, 1st Session, submitted December 18, 1927, resulted in authorization of a project by the Flood Control Act of 1928. The project provided comprehensive flood control for the lower Mississippi Valley below Cairo, Illinois. The Flood Control Act of 1944 authorized the USACE to construct, operate, and maintain water resources development projects. The Flood Control Acts have had an important impact on water and land resources in the proposed project area.

3.1.10.2 WBV Risk Reduction Projects

- In June 2009, the USACE finalized an EA #475 evaluating the potential impacts associated with the proposed stormproofing modifications at 21 existing drainage pump stations in Jefferson Parish, Louisiana. The purpose of this project was to ensure the operability of the stations during hurricanes, storms, and high-water events. The modifications were proposed for those Jefferson Parish pump stations on the east and west banks of the Mississippi River to ensure station operation during, and immediately following, large tropical storm events (USACE 2009m).
- In October 2007, the USACE finalized an EA #454 evaluating the potential impacts associated with the proposed stormproofing modifications at 12 pump stations, which at that time lacked adequate stormproofing measures in Jefferson Parish, Louisiana, to help ensure the operability of the stations during hurricanes, storms, and high-water events. The modifications were proposed for 12 existing pump stations on the east and west banks of the Mississippi River in Jefferson Parish (USACE 2007b).
- In July 2006, the CEMVN Commander signed a FONSI for EA #433 entitled *USACE Response to Hurricanes Katrina and Rita in Louisiana*. The document evaluates the potential impacts associated with the actions taken by the USACE as a result of Hurricanes Katrina and Rita.
- On August 23, 2005, the CEMVN Commander signed a FONSI for EA #422 entitled *Mississippi River Levees – West Bank Gaps, Concrete Slope Pavement Borrow Area Designation, St. Charles and Jefferson Parishes, Louisiana*. The report investigates the impacts of obtaining borrow material from various areas in Louisiana.
- On February 22, 2005, the CEMVN Commander signed a FONSI for EA #306A entitled *West Bank Hurricane Protection Project – East of the Harvey Canal, Floodwall Realignment and Change in Method of Sector Gate*. The report discusses the impacts related to the relocation of a proposed floodwall moved because of the aforementioned sector gate, as authorized by the LPV Project.
- On May 5, 2003, the CEMVN Commander signed a FONSI for EA #337 entitled *Algiers Canal Alternative Borrow Site*.
- On June 19, 2003, the CEMVN Commander signed a FONSI for EA #373 entitled *Lake Cataouatche Levee Enlargement*. The report discusses the impacts related to improvements to a levee from Bayou Segnette State Park to Lake Cataouatche.
- On May 16, 2002, the CEMVN Commander signed a FONSI for EA #306 entitled *West Bank Hurricane Protection Project - Harvey Canal Sector Gate Site Relocation and Construction Method Change*. The report discusses the impacts related to the

relocation of a proposed sector gate within the Harvey Canal, as authorized by the LPV Project.

- On August 30, 2000, the CEMVN Commander signed a FONSI for EA #320 entitled *West Bank Hurricane Protection Features*. The report evaluates the impacts associated with borrow sources and construction options to complete the Westwego to Harvey Canal Hurricane Protection Project.
- The final EIS for the WBV, East of Harvey Canal, Hurricane Protection Project was completed in August 1994. A ROD was signed by the USACE in September 1998.
- The final EIS for the WBV, Lake Cataouatche, Hurricane Protection Project was completed. A ROD was signed by the USACE in September 1998.
- On August 18, 1998, the CEMVN Commander signed a FONSI for EA #258 entitled *Mississippi River Levee Maintenance - Plaquemines West Bank Second Lift, Fort Jackson Borrow Site*.
- In December 1996, the USACE completed a post-authorization change study entitled, *Westwego to Harvey Canal, Louisiana Hurricane Protection Project Lake Cataouatche Area EIS*. The study investigated the feasibility of providing hurricane surge protection to that portion of the west bank of the Mississippi River in Jefferson Parish between Bayou Segnette and the St. Charles Parish line. A Standard Project Hurricane (SPH) level of protection was recommended along the alignment followed by the existing non-Federal levee. The project was authorized by Section 101 (b) of the WRDA of 1996, (P L 104-303) subject to the completion of a final report of the Chief of Engineers, which was signed on December 23, 1996.
- On January 12, 1994, the CEMVN Commander signed a FONSI for EA #198 entitled, *West Bank of the Mississippi River in the Vicinity of New Orleans, Louisiana, Hurricane Protection Project, Westwego to Harvey Canal, Jefferson Parish, Louisiana, Proposed Alternate Borrow Sources and Construction Options*. The report evaluates the impacts associated with borrow sources and construction options to complete the Westwego to Harvey Canal Hurricane Protection Levee.
- In August 1994, the USACE completed a feasibility report entitled *WBV (East of the Harvey Canal)*. The study investigated the feasibility of providing hurricane surge protection to that portion of the west bank of metropolitan New Orleans from the Harvey Canal eastwards to the Mississippi River. The final report recommended that the existing West Bank Hurricane Project, Jefferson Parish, Louisiana, authorized by the WRDA of 1986 (P L 99-662), approved November 17, 1986, be modified to provide additional hurricane damage risk reduction east of the Harvey Canal. The report also recommended that the level of protection for the area east of the Algiers Canal deviate from the National Economic Development Plan's level of protection and provide protection for the SPH. The Division Engineer's Notice was issued on September 1, 1994. The Chief of Engineer's report was issued on May 1, 1995. Pre-construction, engineering, and design was initiated in late 1994 and is continuing. The WRDA of 1996 authorized the project.
- On March 20, 1992, the CEMVN Commander signed a FONSI for EA #165 entitled *Westwego to Harvey Canal Disposal Site*. The report evaluates the environmental impacts associated with the disposal site to stockpile excavated materials near the existing V-line levee, Estelle Pumping Station, Jefferson Parish.

- In February 1992, the USACE completed a reconnaissance study entitled *West Bank Hurricane Protection, Lake Cataouatche, Louisiana*. The study investigated the feasibility of providing hurricane surge protection to that portion of the west bank of the Mississippi River in Jefferson Parish, between Bayou Segnette and the St. Charles Parish line. The study found a 100-year level of protection to be economically justified based on constructing a combination levee/sheet pile wall along the alignment followed by the existing non-Federal levee. Due to potential impacts on the Westwego to Harvey Canal project, the study is proceeding as a post-authorization change.
- On June 3, 1991, the CEMVN Commander signed a FONSI for EA #136 entitled *West Bank Additional Borrow Site between LA 45 and Estelle Pump Station*. The report evaluated the impacts associated with design changes to the Westwego to Harvey Canal Hurricane Protection Project since EA #121.
- On March 15, 1990, the CEMVN Commander signed a FONSI for EA #121 entitled *West Bank Westwego to Harvey Changes to EIS*. The report addresses the impacts associated with the use of borrow material from Fort Jackson for WBV construction. The material was used for constructing the second lift for the Plaquemines West Bank levee upgrade as part of WBV construction.
- In December 1986, the USACE completed a Feasibility Report and EIS entitled, *West Bank of the Mississippi River in the Vicinity of New Orleans, Louisiana*. The report investigates the feasibility of providing hurricane surge protection to that portion of the west bank of the Mississippi River in Jefferson Parish between the Harvey Canal and Westwego, and down to the vicinity of Crown Point, Louisiana. The report recommends implementing a plan that would provide SPH-level of protection to an area on the west bank between Westwego and the Harvey Canal north of Crown Point. The project was authorized by the WRDA of 1986 (P L 99-662). Construction of the project was initiated in early 1991.

3.2 COASTAL AND WETLANDS RESTORATION AND PROTECTION IN LOUISIANA

Major coastal wetlands restoration and protection projects in the region are listed in appendix L and are summarized in this section; their locations are provided in figure 3-7. They are components of the overall comprehensive regional planning and building efforts for southeastern Louisiana.

3.2.1 Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA)

The CWPPRA (or "Breux Act") was the first Federal statutorily mandated restoration of Louisiana's coastal wetlands and the first stable source of Federal funds dedicated exclusively to the long-term restoration of coastal wetlands (Louisiana Coastal Wetlands Conservation and Restoration Task Force [Task Force] 2006). CWPPRA provides for targeted funds to be used for planning and implementing projects that create, protect, restore, and enhance wetlands in coastal Louisiana. CWPPRA project planning activities are 100 percent Federally funded. Once a project is approved, cost sharing is 85 percent Federal and 15 percent non-Federal. The non-Federal funds are often State funds. CWPPRA was passed in 1990 and is authorized until 2019. By January 2012, 187 CWPPRA projects were approved, 92 were constructed, 49 are under construction or planned, and 36 have been de-authorized or transferred to another program (Scott Wendell, personal communication).

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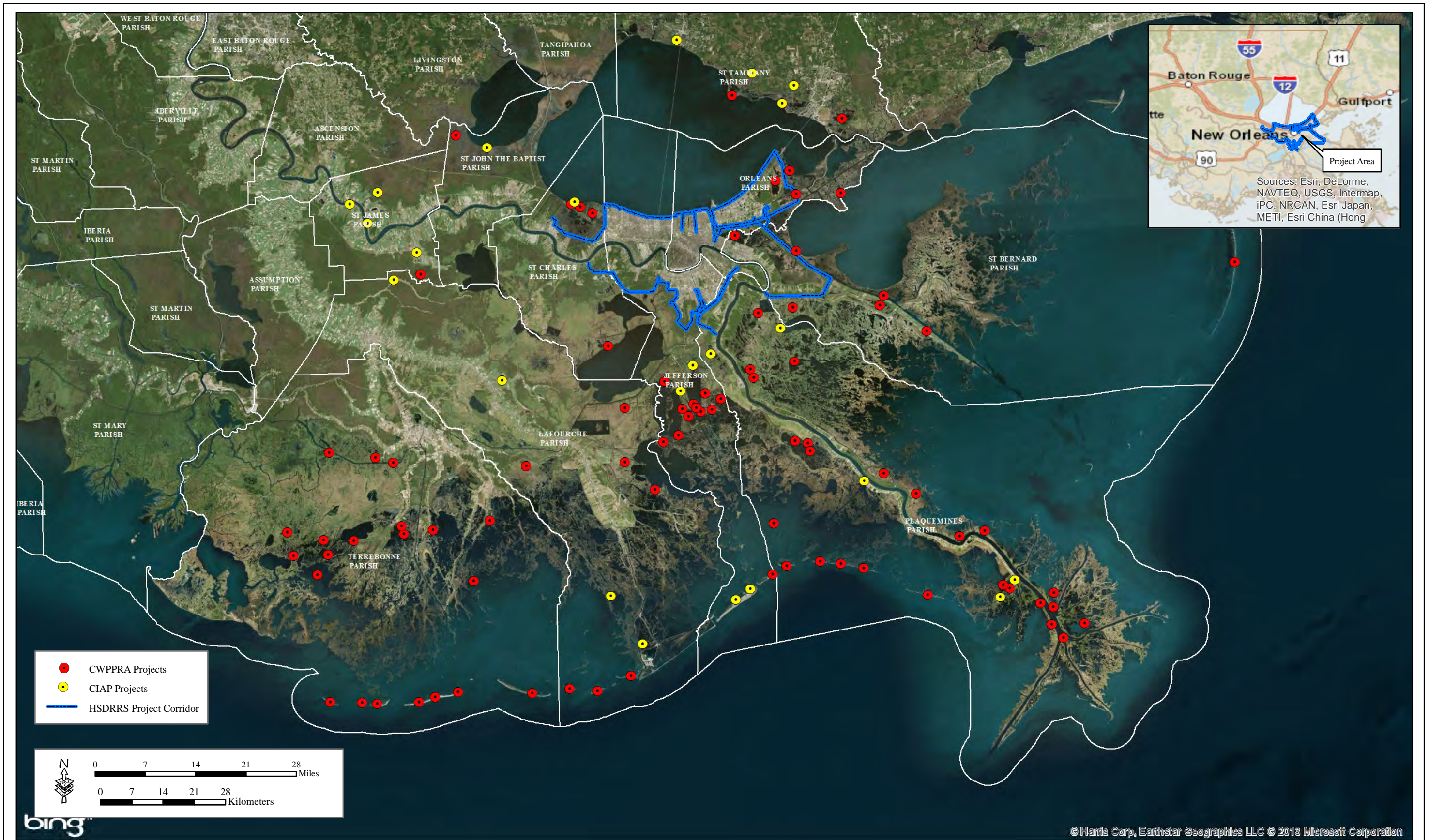


Figure 3-7: Major Coastal Restoration and Protection Projects in Louisiana

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A list of CWPPRA projects with project descriptions is available at <http://www.lacoast.gov/projects>. Additionally, those within the HSDRRS project areas are listed in appendix L. A project status summary can be found in the CWPPRA Desk Reference available at the website. In general, there are nine different methods or restoration techniques that the CWPPRA projects can employ to restore or protect Louisiana coastal wetlands, namely:

- Diversion – Introduces freshwater along with nutrients and sediments from major rivers to wetlands or open water areas that have been deprived of freshwater and sediments or that have been impacted by saltwater intrusion.
- Outfall management – The regulation of water levels and flow regimes in order to increase freshwater, nutrients, sediment dispersion, and retention time within the receiving waterway. This technique is often used with diversion projects.
- Hydrologic restoration – Modification of altered drainage patterns to mimic natural drainage patterns for habitat restoration.
- Shoreline protection – A method used to reduce or stop shoreline erosion.
- Barrier island restoration – Various techniques may be used to restore island size and configuration and include deposition of dredged material and breakwater placement, as well as fencing and plantings for beach stabilization.
- Marsh creation – Direct creation or nourishment of marsh through placement of dredged material.
- Sediment and nutrient trapping – The installation of flow control structures to promote sediment accretion and nutrient uptake.
- Vegetative planting – A technique used in conjunction with other restoration methods to create emergent marsh by planting stems or clumps of native marsh plants.
- Ridge restoration – The reestablishment of natural ridges to protect, maintain, or restore hydrologic and salinity settings. This technique also reduces wave energy into coastal wetlands complexes (LaCoast 2010).

The CWPPRA Task Force is composed of the State of Louisiana and five Federal agencies: USEPA, USFWS, U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS), National Oceanographic and Atmospheric Administration (NOAA) – NMFS, and USACE. The Governor’s Office of Coastal Activities represents the State of Louisiana. The CWPPRA Task Force annually develops a list of high-priority projects to be constructed. To date, 21 such priority lists have been formulated. The projects funded by CWPPRA focus on marsh creation, restoration, protection, or enhancement.

The USACE administers budgetary accounting, tracks the project status of all CWPPRA projects, and also constructs approved CWPPRA projects whenever it is assigned as lead agency for that project. All other projects are constructed by one of the other four Federal agencies. The Coastal Protection and Restoration Authority Board of Louisiana (CPRAB), formerly CPRA, is responsible for monitoring the effectiveness of the wetlands restoration projects implemented under CWPPRA.

CWPPRA projects are generally small-scale and localized. To address projected future loss of coastal Louisiana, larger projects with more ecosystem-scale impacts must be constructed; however, many larger projects exceed the funding capacity and authorization period of

CWPPRA. The LCA initiative began in 2001 to fill this need and seeks future WRDA authorization and funding of large-scale coastal restoration projects in Louisiana.

3.2.2 Louisiana Coastal Area Ecosystem Restoration Plan

Unless otherwise cited, the following information was extracted from the LCA, Louisiana Ecosystem Restoration Study (USACE 2004b).

In 1990, passage of the CWPPRA, (P L 101-646, Title III) provided authorization and funding for the Task Force to begin actions to curtail wetlands losses. In 1998, the State of Louisiana and the Federal agencies charged with restoring and protecting the remainder of Louisiana's valuable coastal wetlands developed the *Coast 2050: Toward a Sustainable Coastal Louisiana* report, known as the Coast 2050 Plan. The plan combines elements of all previous efforts, along with new initiatives from private citizens, local governments, state and Federal agency personnel, and the scientific community (Task Force and the Wetlands Conservation and Restoration Authority 1998).

The underlying principle of the Coast 2050 Plan is to restore or mimic the natural processes that built and maintained coastal Louisiana. This plan proposed ecosystem restoration strategies that would result in efforts larger in scale than any that had been implemented in the past. The Coast 2050 Plan was the basis for the May 1999 report, entitled *Section 905(b) WRDA of 1986 Analysis Louisiana Coastal Area, Louisiana -- Ecosystem Restoration*. This reconnaissance-level effort evaluated the Coast 2050 Plan as a whole and expressed a Federal interest in proceeding to the feasibility phase. In 2000, it was envisioned that a series of feasibility reports would be prepared over a 10-year period.

The first feasibility efforts focused on the Barataria Basin and involved marsh creation and barrier shoreline restoration. However, early in FY 2002, it was recognized that it would be more efficient to develop a comprehensive coastal restoration effort that could be submitted to Congress as a blueprint for future restoration efforts. As a result, the USACE and the State of Louisiana initiated the *LCA Comprehensive Coastwide Ecosystem Restoration Study*. In FY 2004, it was determined that efforts should begin with highly cost-effective restoration features that address the most critical needs of coastal Louisiana, as well as large-scale and long-term restoration concepts.

The goal of the LCA Plan is to reverse the current trend of degradation of the coastal ecosystem. The plan maximizes the use of restoration strategies that reintroduce historic flows of river water, nutrients, and sediment to coastal wetlands and maintain the structural integrity of the coastal ecosystem.

An interagency PDT was assembled to conduct the requisite studies and analyses and develop the alternative plans and reports for the LCA Study. The PDT was composed of staff from the USACE, State of Louisiana (the non-Federal sponsor), USFWS, NMFS, USEPA, U.S. Geological Survey (USGS), and NRCS. The USACE and the State of Louisiana also enlisted the aid of over 120 scientists, engineers, and planners from across the Nation to provide advice and guidance, carry out complex modeling efforts, and review results.

The LCA Plan included five near-term critical restoration features, which were recommended for specific authorization for implementation, subject to approval of feasibility-level decision documents by the Secretary:

- MRGO environmental restoration features
- Small diversion at Hope Canal
- Barataria Basin barrier shoreline restoration (Caminada Headland and Shell Island reaches)

- Small Bayou Lafourche reintroduction
- Medium diversion with dedicated dredging at Myrtle Grove

The LCA Study was released for public comment in 2004. The LCA Study made several recommendations that were ultimately authorized by the WRDA of 2007 (Title VII). In addition to the five near-term critical restoration projects, the following were added:

- Ten additional near-term critical restoration projects
- Beneficial use of dredged material
- Authority to initiate studies of modifications to existing water control structures
- Science and technology demonstration projects
- Science and technology program
- Studies on long-term restoration concepts

Implementation guidance for the LCA as authorized by the WRDA of 2007 (Title VII) was issued by the USACE on July 10, 2009, and funding is available for the construction of the demonstration projects and near-term critical restoration projects. A list of LCA Plan projects can be found in appendix L. Five LCA Supplemental EISs have been completed and RODs signed for each one. The State of Louisiana has terminated the cost-share agreements for a number of authorized LCA projects.

3.2.3 Louisiana Coastal Protection and Restoration (LACPR)

Before Congress could consider authorizing the LCA Plan's recommendations, Hurricanes Katrina and Rita hit Louisiana in 2005. Subsequently, the Energy and Water Development Appropriations Act (EWDAA) of 2006 [P L 109-103] passed in November 2005, and the DoD, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic and Influenza Act, 2006 passed on December 30, 2005, as part of the Defense Appropriations Act [P L 109-148]. These laws directed the USACE to examine, assess, and present recommendations for a comprehensive approach to coastal restoration, hurricane storm damage reduction, and flood control. These Congressional directives represent the first integration of planning to address these three enormous challenges. The combined planning will be accomplished through the LACPR effort. LACPR is not a construction project; it is a collaboration managed by the USACE that will generate a single document, a technical report, to provide guidance to Congress in its long-term decision making regarding hurricane damage risk reduction and coastal restoration.

The purpose of the LACPR is to identify risk reduction measures that can be integrated to form a system that will provide enhanced protection of coastal communities and infrastructure, as well as restoration of coastal ecosystems. The scope of the LACPR is to address the full range of flood damage risk reduction, coastal restoration, and hurricane damage risk reduction measures available, including those needed to provide comprehensive "Category 5" protection.

The overall goals of LACPR are to:

- Conduct a comprehensive hurricane damage risk reduction analysis and design to develop and present a full range of flood damage reduction, coastal restoration, and hurricane damage risk reduction measures for south Louisiana.
- Evaluate risk reduction for a range of storms from the 100-year to the 1,000-year storm event (which encompasses a range of "Category 5" events) within the planning area.
- Conduct a transparent planning process to include independent technical review and external peer review.

- Engage the State of Louisiana and Federal agencies, stakeholders, and the general public as active partners in the planning process.

The LACPR effort has been, and will continue to be, integrated with the Mississippi Coastal Improvements Program efforts to ensure a consistent systems approach to modeling storm events, data sharing, alternatives analysis, and lessons learned, as appropriate. The LACPR effort is also closely tied with the State of Louisiana's Master Plan for coastal restoration and hurricane damage risk reduction. The LACPR team developed the following processes to facilitate comprehensive risk reduction analysis:

- Risk-based Hurricane Frequency Simulation
- Economic Evaluation
- Cultural Resources Evaluation
- Coastal Restoration Evaluation
- Plan Formulation
- Multi-criteria Decision Analysis
- Public Stakeholder Involvement

One of the assumptions used to develop the State Master Plan and adopted by LACPR is that hurricane damage risk reduction plans must rely on multiple lines of defense. The multiple lines of defense strategy involves using natural features such as barrier islands, marshes, and ridges to complement engineered structures such as highways, levees, and raised homes. The multiple lines of defense approach avoids reliance on single risk reduction measures, which, if compromised, would leave vulnerable areas without recourse.

The LACPR team provided the National Academy of Sciences with the LACPR Draft Technical Report (USACE 2008e) for external peer review. The Final Technical Report was released in June 2009 (USACE 2009o) for review by other Federal agencies, the State of Louisiana, NGOs, and the public. A public meeting was held in Slidell, Louisiana, on June 16, 2009, to present the Final Technical Report to the public and local government stakeholders. The Final Technical and Comment Addendum Report (containing the Summary Report, Final Technical Report, and Comment Addendum) was completed in August 2009.

3.2.4 Louisiana Coastal Impact Assistance Program (CIAP)

The Energy Policy Act of 2005 (P L 109-58) was signed into law in August 2005. Section 384 of the act establishes the CIAP, which authorizes funds to be distributed to Outer Continental Shelf (OCS) oil- and gas-producing states to mitigate the impacts of OCS oil and gas exploration, development, and production activities.

Under CIAP, the Secretary of the Interior is authorized to distribute \$250 million per FY to the producing states and coastal political subdivisions for FY 2007 through FY 2011. This money is to be shared among Alabama, Alaska, California, Louisiana, Mississippi, and Texas based upon allocation formulas prescribed by the Act. Pursuant to the Act, a producing state or coastal political subdivision shall use all amounts received under this section for one or more of the following purposes (Minerals Management Service [MMS] 2008):

- Projects and activities for the conservation, protection, or restoration of coastal areas, including wetlands
- Mitigation of damage to fish, wildlife, or natural resources
- Planning assistance and the administrative costs of complying with this section

- Implementation of a Federally approved marine, coastal, or comprehensive conservation management plan
- Mitigation of the impact of OCS activities through funding of onshore infrastructure projects and public service needs

On June 1, 2007, Louisiana submitted a CIAP plan for funding consideration to the MMS, now known as Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). It was approved by MMS on November 29, 2007. Louisiana was the first state to receive CIAP grants – and received a total of 49 in early 2008 (CPRA 2009). In advance of receiving CIAP grants, the State of Louisiana started work on projects in the approved CIAP plan.

The goals of the Louisiana CIAP are to:

- 1) implement, support, and accelerate effective and timely coastal conservation and restoration projects; and
- 2) implement, support, and accelerate coastal infrastructure projects that mitigate onshore impacts within the OCS.

The conservation and restoration objectives of the Louisiana CIAP are to implement Coast 2050, CWPPRA projects, and LCA Plan features that can be initiated in the near term and to implement a coastal forest conservation and restoration initiative. Additionally, CIAP will support projects to benefit wetlands and aquatic habitats in inland portions of coastal parishes and conduct monitoring and related science-support activities. The objectives of the infrastructure portion of the Louisiana CIAP are to implement and support projects that will protect the coastal communities and infrastructure involved in and impacted by OCS-related activities, as well as to implement and support onshore projects that address other infrastructure needs associated with and impacted by OCS-related activities (Louisiana Department of Natural Resources [LDNR] and Office of Coastal Restoration and Management 2007).

Most state CIAP restoration projects have had some level of work initiated. As of August 2011, 88 percent of all CIAP projects in Louisiana were under design, in construction, or completed (CPRA 2011a). The following CIAP projects are in the planning and design phase (CPRA 2011a):

- Violet Diversion
- Orleans Land Bridge Shoreline Protection and Marsh Creation
- Mississippi River Long Distance Sediment Pipeline
- Grand Liard Marsh and Ridge Restoration
- LaBranche East Marsh Creation
- Jump Basin Dredging and Marsh Creation
- Lake Lery Rim Reestablishment and Marsh Creation
- West Caminada Headland Beach/Dune Restoration and Marsh Creation
- Bayou Lamoque Floodgate Removal

Additionally, the following CIAP projects have been completed (CPRA 2011b):

- Dedicated Dredging on the Barataria Basin Landbridge, completed April 2010
- Barataria Basin Landbridge Shoreline Protection, Phase 1 and 2, completed March 2009
- Lake Salvador Shoreline Protection (Phase III)
- Blind River Freshwater Diversion

A complete listing of all CIAP projects in southeast Louisiana is provided in appendix L.

3.2.5 Louisiana's Comprehensive Master Plan for a Sustainable Coast (State Master Plan)

In November 2005, the Louisiana Legislature passed Act 8, which created the Coastal Protection and Restoration Authority and charged it with developing a comprehensive coastal protection plan that considers both "hurricane protection and the protection, conservation, restoration and enhancement of coastal wetlands and barrier shorelines or reefs." The Plan is to be updated every five years. The first State Master Plan was submitted to the Louisiana State Legislature on April 30, 2007. On May 22, 2012 the Louisiana Legislature approved the 2012 State Master Plan.

The State Master Plan presents a series of recommended hurricane damage risk reduction and coastal restoration measures, as well as a management strategy for implementing the measures.

The measures contained in the plan can be broken down into three groups, based upon the broad outcomes they deliver. These include the following three broad groups:

- Restoring Sustainability to the Mississippi River Delta - Reconnecting the Mississippi River to the wetlands through controlled diversions would restore flows of water through the wetlands so that the ecosystem can retain sediment and nutrients. Elements of this group include land-building diversions, land-sustaining diversions, marsh restoration with dredged material, use of navigation channels as water distributaries, barrier shoreline restoration, ridge restoration, shoreline stabilization, and closure of the MRGO to navigation (as described in section 3.1.7).
- Restoring Sustainability to the Atchafalaya River Delta and Chenier Plain - The Atchafalaya River Delta is the only region of coastal Louisiana that is building land naturally, and the State Master Plan seeks to take advantage of this resource. Further west in the Chenier Plain, navigation channels and canals have allowed saltwater to penetrate inland, destroying fragile marsh and impinging on freshwater lakes. The Chenier Plain Freshwater and Sediment Management and Reallocation Plan, recommended in the Master Plan would help fine-tune appropriate measures for the region. Elements of this group include managing water and sediment, marsh restoration with dredged material, barrier shoreline restoration, and lake shoreline restoration.
- Hurricane Risk Reduction - Elements to be considered by this group include consideration of the entire system, use of non-structural elements to reduce risk, and focused structural solutions.

3.3 OTHER PROJECTS IN SOUTHEAST LOUISIANA

3.3.1 Regulatory Permits

Additional cumulative impacts in the project area have been caused by development activities within areas subject to USACE regulatory authority. Accordingly, regulatory permit information from the CEMVN Regulatory Program Office is included in this document.

- The USACE has regulated certain activities in the Nation's waters since 1890. The authority for the Regulatory Program is based on the following laws: the Rivers and Harbors Act of 1890 (superseded) and 1899 (33 U.S.C. §§401-418), Section 404 of the Clean Water Act (33 U.S.C. §1344), and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. §1413). Different types of permits are issued by the USACE, including:

- Individual permits – involves an evaluation of individual proposed projects in a three-step process: pre-application consultation (optional), formal permit application review, and decision making. The decision to issue an individual permit is based on an evaluation of the proposal’s probable impacts on the public interest and, for proposals to fill waters and wetlands, whether the project complies with the USEPA’s CWA Section 404(b)(1) guidelines. The individual permit process allows for the consideration of potentially less environmentally damaging alternatives to accomplish the project purpose and an evaluation of measures to reduce the impacts of the project on natural resources.
- Nationwide General permits – A type of general permit that authorizes nationwide a category of activity that has minimal impacts. The regulations governing Nationwide General permits are found at 33 CFR 330. There are currently 50 Nationwide General permits (March 19, 2012; expires March 18, 2017) with 28 general conditions.
- Regional General permits – Permits issued regionally for a category or categories of activities that cause only minimal individual and cumulative adverse impacts.
- Programmatic General permits – Permits that compliment certain other Federal, state, or local agency programs in order to avoid duplicative requirements for the same activity where the environmental consequences of the activity would be individually and cumulatively minimal (e.g., NOD [New Orleans District] Programmatic General Permit Coastal Zone).

A total of 933 individual permits were issued between July 2007 and June 2011 by the CEMVN Regulatory Program Office and, of those, 231 projects were located in the five-parish HSDRRS project area. Together, those projects impacted approximately 1,299.2 acres of jurisdictional waters of the U.S., including wetlands. The number of permits issued in each parish was:

- St. Charles Parish – 33
- Jefferson Parish – 60
- Orleans Parish – 30
- St. Bernard Parish – 43
- Plaquemines Parish – 65

In addition, from July 2007 to June 2011 there were 917 total Nationwide General permits, 1,046 total Regional General permits, and 2,429 total Programmatic General permits issued by the CEMVN Regulatory Branch within the District’s jurisdiction. Of those permits issued, 68 Nationwide, 342 Regional General, and 937 Programmatic General permits were for projects located in the five HSDRRS parishes (table 3-1).

Table 3-1. General Permits Issued by CEMVN Regulatory Branch in the HSDRRS Area (July 2007 to June 2011)

Parish	Nationwide	Regional	Programmatic
St. Charles	7	46	98
Jefferson	17	60	135
Orleans	3	14	34
St. Bernard	20	28	55
Plaquemines	21	194	615

The 231 standard permits issued within the five HSDRRS parishes can be found in appendix L under the specific type of regional project that best described the permit project action. The remaining types of permits were not collected for inclusion in appendix L, as these permits, by

definition, cannot cause more than minimal individual and cumulative adverse impacts on natural and cultural resources.

3.3.2 BP Oil Spill

On April 20, 2010, the British Petroleum Private Limited Company (BP) oil spill occurred off of the coast of Louisiana, approximately 50 miles southwest of the Mississippi Delta in the Gulf of Mexico. The BP Deepwater Horizon drilling rig exploded, killing 11 workers and releasing crude oil during a 3-month period. The spill caused extensive damage to marine and wildlife species and associated habitats, including wetlands, severely affected the fishing and tourism industry, and became the largest environmental disaster in U.S. history. The broken wellhead released approximately 4.9 million barrels (205.8 million gallons) of oil into the Gulf of Mexico (Hoch 2010). By September 19, 2010, the relief well process was successfully completed and the well was considered capped. Efforts to contain the oil on the surface away from sensitive areas, to dilute and disperse the oil to less sensitive areas, and to remove it from the water consisted of developing miles of containment boom, releasing chemical dispersants into the water, and removing the oil by burning, filtering, and collecting. The wellhead was capped on July 15, 2010, and, by July 30, the oil appeared to have dissipated more rapidly than expected due to a combination of factors including the natural capacity of the region to break down oil, winds from storms rapidly dispersed the oil, and the cleanup response by BP and the government (Gillis and Robertson 2010). However, the amount of oil recovered was controversial, and several scientists opposed NOAA's findings that most of the oil had been removed. In August 2011, additional oil was reported near the location where the Deepwater Horizon spill occurred, and scientific analysis confirmed that the oil was a chemical match to the capped well. The oil was determined to be too dispersed to recover.

In April 2011, BP agreed to provide \$1 billion toward early restoration projects in the Gulf of Mexico. These early restoration funds are part of the natural resource damage assessment process, and the natural resource trustees (which are the states of Alabama, Florida, Louisiana, Mississippi, and Texas, the Department of Interior, and the NOAA) will direct the money towards the early restoration projects and continue the natural resource damage assessment process to determine the full extent of required compensation to the public for the entire injury. Of the \$1 billion, each state will select and implement \$100 million in projects, the Department of Interior and NOAA will each select and implement \$100 million in projects, and the remaining \$300 million will be used for projects selected by the Department of Interior and NOAA from proposals submitted by state trustees (Restore The Gulf 2011). Future projects funded as part of the natural resource damage assessment process are not known at this time, but it is likely that numerous ecosystem restoration projects throughout the Gulf of Mexico will be funded as a result.

SECTION 4.0
AFFECTED ENVIRONMENT, HSDRRS COMPONENT PROJECT IMPACTS,
AND HSDRRS CUMULATIVE IMPACTS

4.0 AFFECTED ENVIRONMENT, HSDRRS COMPONENT PROJECT IMPACTS, AND HSDRRS CUMULATIVE IMPACTS

This section of the CED includes discussion of the affected environment, the HSDRRS component impacts on the affected environment, and the HSDRRS cumulative impacts. The affected environment was considered to be the HSDRRS project area as defined by the nine sub-basins and the 10 parishes and Hancock County, Mississippi, located beyond boundaries of the HSDRRS, as defined by the NEPA Alternative Arrangements. Refer to tables 2-2 and 2-4 and the corresponding Location Maps (appendix D) for all the HSDRRS components.

The HSDRRS impacts discussed here summarize and update those impacts originally presented in the IERs completed by November 15, 2010, and include an evaluation of the impacts from HSDRRS construction completed by July 2011. Further, if need for clarification, insufficient information, or data gaps were noted in the IERs, they are addressed in this document or it is noted that they still exist; those data gaps will be addressed in later supplement(s) to the CED, where possible.

Impacts are considered to be any adverse or beneficial consequences on the human or natural environment caused by the implementation of an action and include any irreversible and irretrievable commitments of resources should the action be implemented. In addition, impacts on the human and natural environment can be considered to be direct or indirect. Direct impacts are those that are caused by the action and occur at the same time and place (40 CFR §1508.8(a)). Indirect impacts are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR §1508.8(b)). The NEPA requires a Federal agency to consider not only the direct and indirect impacts of a proposed action, but also the cumulative impacts of the action.

The terms “adverse” and “significant” are used in the CED with respect to impacts from the HSDRRS and are defined in this document as the following:

- Adverse – is a negative impact on the human, natural, and/or physical environment
- Significant – a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and/or objects of historic or aesthetic value.

For the purpose of the CED analysis, the magnitude of impacts will be classified as negligible, minor, moderate, or major and are defined as follows:

- Negligible: A resource was not affected or the effects were at or below the level of detection; changes were not of any measurable or perceptible consequence.
- Minor: Effects on a resource were detectable, although the effects were localized, small, and of little consequence to the sustainability of the resource.
- Moderate: Effects on a resource were readily detectable, long-term, localized, and measurable.
- Major: Effects on a resource were obvious, long-term, and had substantial consequences on a regional scale.

Cumulative impacts are defined in the CED as those impacts that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. A table of representative regional projects is included in appendix L, which is used in the analysis for the cumulative impacts of other present and future actions. Appendix L includes the name of the project, the location, and other pertinent information, such as the status of the project or impacts, if known.

Although the general public in the Greater New Orleans Metropolitan Area has expressed an interest in the Federal government constructing a 500-year level of risk reduction system, a project of that magnitude would require Congressional authorization and dedicated appropriations that place the prospect of such a project outside of the reasonably foreseeable future. Therefore, a 500-year level of risk reduction system was not analyzed as part of the cumulative impact analysis addressed in this phase of the CED.

When the NEPA Alternative Arrangements process and the preparation of the CED were outlined in 2007, it was not conceived that design and associated environmental compliance activities or mitigation measures such as long-term monitoring would continue well beyond June 2011. Therefore, since the HSDRRS design and construction are continuing at the same time this document is being prepared, the cumulative impacts analysis will incorporate information from IER and IER Supplemental documents completed by November 15, 2010. IER documents and long-term monitoring and analysis that were not completed by November 15, 2010, will be described in future supplements to the CED.

The majority of the HSDRRS construction is complete or under way. Therefore, the Proposed Action in many IERs and IER Supplemental documents and the associated impacts will have occurred. The impacts from completed HSDRRS components will be discussed in the CED as having already occurred. However, future levee lifts will be discussed as the HSDRRS 2057 construction and will be analyzed as proposed future construction that has not yet occurred. As such, any impacts from these actions will be discussed in the future tense. A list of the proposed HSDRRS levee lifts for the 50-year life of the HSDRRS can be found in section 2.2, table 2-3, and these future lifts could result in an expanded levee footprint, based on the necessary future elevations. In addition, borrow sites that have not been utilized for the HSDRRS as of July 2011 will be classified as future proposed borrow sites. Therefore, their impacts will be discussed in the CED as potential future HSDRRS impacts. In summary, the impacts discussion for each resource presents what was proposed to be constructed in the IERs completed by November 15, 2010, what was constructed for those HSDRRS reaches constructed by July 2011, and what is yet to be authorized for construction through the 50-year design life of the HSDRRS.

At this time, future levee lifts to maintain the 100-year level of risk reduction through the year 2057 are not authorized and no such levee lifts are currently planned. It is estimated that the total future levee lifts through 2057 to provide the 100-year level of risk reduction would need approximately 7.3 million cy of borrow to achieve project goals. For purposes of analysis, it is assumed that the required borrow material would not necessarily be removed from previously identified borrow sites, but instead could come from any available source in the region. This is because the NEPA Alternative Arrangements do not apply to this future construction work, that various waivers granted to the CEMVN Chief of Real Estate to deviate from standard borrow acquisition process will not apply, and the Authorizations for HSDRRS construction were specifically for emergency work. Therefore, after completion of the HSDRRS, additional NEPA analyses would be conducted on the impacts of removing soil from borrow areas for all future maintenance levee lifts through 2057. However, for purposes of impact analysis, it is assumed that all borrow sites identified for use in future levee lifts would be designed and constructed in accordance with the design guidelines for borrow areas, which can be found in the USACE 1986, Report 4.

Although the HSDRRS subject to NEPA Alternative Arrangements comprises 217 miles of levees, floodwalls, floodgates, and other structures providing flood risk reduction, the construction activities necessary to bring the HSDRRS elevation to the 100-year level of risk reduction were limited in scope. This is primarily because most of the permanent changes to infrastructure occurred within the footprint of existing structures. To clarify where HSDRRS footprint expansion was required to meet the 100-year level of risk reduction, table 4-1 provides a summary of those changes, as described by the IER and IER Supplemental documents completed by November 15, 2010. The projects described by IER 11 (Tiers 1 and 2) occur in both the New Orleans East and Chalmette Loop sub-basins, and the Borgne barrier described in IER 11 Tier 2 Borgne is located between the two sub-basins and provides the HSDRRS connection between the GIWW and MRGO levees and floodwalls. Most of the previously completed studies from the IER 11 HSDRRS projects evaluated the overall impacts on sensitive resources from the construction and operation of the Seabrook gate complex and the Borgne barrier. Therefore, where appropriate, impacts on resources from IER 11 Tier 2 Borgne described in this section of the CED are contained in the New Orleans East sub-basin.

Table 4-1. The HSDRRS Actions Resulting in an Increased Project Footprint

IER* #	Sub-basins	Footprint Change or Expanded ROW
1	St. Charles	Increase footprint 50 ft on flood side for 2,540 ft; increase ROW 100-250 ft on both sides
S 1	St. Charles	Shift of levee to flood side
2	Jefferson and Orleans	Move T-wall 35 ft to flood side
S 2	Jefferson and Orleans	Move T-wall 35 ft to flood side
3	Jefferson East	Raising the levee from current height to 17.5 ft, widen crown of levee from 7 ft to 10 ft, slight flood-side shift could be incorporated as needed, adding foreshore protection +6 ft at 150 ft from the centerline on the floodside
S 3.a	Jefferson East	Construction of wave attenuation berms and foreshore along lake front and T-wall, overpass bridge, and traffic detour land bridge spans as the abutment
4	Orleans	Rebuilding and/or modifying earthen levees and floodwalls to an elevation of 16 ft on top of existing levee, replacing or adding new floodgates, modifying the gate structure, rebuilding roadway ramps to an elevation of 21.1 ft.
5	Jefferson and Orleans	Total permanent ROW acquisition of 79 acres of land and water for all three proposed stations. Six acres of temporary ROW acquisition for the London Avenue Canal Proposed Action.
6	New Orleans East	34 ft of floodwall and 28 ft of levee in new locations
S 6	New Orleans East	Realign floodwall 300 ft south of current floodwall
7	New Orleans East	Some levees in LPV-109 were shifted 61 ft toward protected side
S 7	New Orleans East	Temporary traffic control bridge off I-10. A required footprint for the earthen ramp would be widened by ~ 50-100 ft on each side of the highway and new easement between ramp toe and limits would be built.
8	St. Bernard	Flow control structure on the flood side and adjacent to an existing structure at an elevation of + 31 ft
9	Chalmette Loop	New floodwall alignment to replace the existing floodwall at an elevation of +26 ft., a 300-ft wide corridor, permanent ROW of ~ 10 acres
10	Chalmette Loop	Eight pipelines moved due to T-wall caps
11 Tier 1	Inner Harbor Navigation Canal	Tier 1 is a programmatic document; see Tier 2 documents for project footprint changes

Table 4-1, continued

IER* #	Sub-basins	Footprint Change or Expanded ROW
11 Tier 2 Borgne	New Orleans East	Construct an approximately 2-mile-long floodwall/gated system from the north side of the GIWW to the west side of the MRGO. An approximately 350 ft wide channel would be dredged through the marsh for the floodwall construction.
S 11 Tier 2 Borgne	New Orleans East	Raise the protected side ground surface
S 11 Tier 2 Pontchartrain	New Orleans East	14 acres of permanent easement and 12 acres for temporary easement
12	Jefferson, Orleans, and Plaquemines	Constructing ~ 3 miles of levee and floodwall that would be shifted 58 ft to the protected side of the centerline of the existing levee. Earthen levee enlargement with a protected side shift that is partially outside the existing ROW. Additional 125 ft of permanent ROW along V-line levee. Relocation of drainage canal 200 ft to the protected side.
S 12	Jefferson, Orleans, and Plaquemines	Access road to golf course
S 12.a	Jefferson, Orleans, and Plaquemines	Protected side shift would be reduced, no need for a new ROW
13	Plaquemines	Protected side shift, enlargement of the levee on the protected side
14	Harvey Westwego	New ROW of 40 - 50 ft required on protected side, ROW of 10-20 ft needed on flood side
S 14.a	Harvey Westwego	New ROW of 100 ft on flood side
15	Lake Cataouatche	Flood-side shift of the levee west ~ 110 ft. The construction of ~ 6.84 miles of uniform-design, protected-side shift of levee. The construction of ~ 1,450 ft of t-wall floodwall to ~ +15.5 ft.
16	Lake Cataouatche	ROW expanded to 1,100 ft along levee on west side of Bayou Verret closure, ROW expanded by 100 ft on flood-side portion ~ length 9,600 ft, ROW expanded to 700 ft on side around Bayou Verret closure
S 16.a	Jefferson and St. Charles	Additional ROW ~ 5 acres for temporary work, ~ 0.7 and 2.6 acres of ROW for Mississippi River Levee
17	Lake Cataouatche	ROW shift of 200 ft to 300 ft toward flood side along Reach 1 south of Lapalco Blvd, ROW expansion north of Lapalco Blvd (absorbed ~ 12 parking spaces), new ROW around Bayou Segnette ~ 40 acres
18	Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard	Potentially excavating all suitable material from 12 proposed borrow sites. Including a total of 17.8 acres of access corridor.
19	Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines	Potentially excavating all suitable material from nine proposed borrow sites
22	Jefferson and Plaquemines	Potentially excavating all suitable material from five proposed borrow sites. Including a total of 10.3 acres of access corridor.
23	St. Bernard, St. Charles, Plaquemines	Potentially excavating all suitable material from five proposed borrow sites
25	Orleans, Jefferson, and Plaquemines	Potentially excavating all suitable material from four proposed borrow sites. Including a total of 19.45 acres of access corridor.
26	Jefferson, Plaquemines, and St. John the Baptist	Potentially excavating all suitable material from five proposed borrow sites

Table 4-1, continued

IER* #	Sub-basins	Footprint Change or Expanded ROW
27	Jefferson and Orleans	All restoration/reinforcement methods will be conducted with approximately the same footprint, within existing right of way
28	Plaquemines, St. Bernard and Jefferson	Potentially excavating all suitable material from three proposed borrow sites, 0.29 acre of access corridor
29	St. John the Baptist and St. Tammany	Potentially excavating all suitable material from three proposed borrow sites
30	St. Bernard and St. James	Potentially excavating all suitable material from three proposed borrow sites
31	East Baton Rouge, Jefferson, Lafourche, Plaquemines, St. Bernard, and St. Tammany	Potentially excavating all suitable material from 10 proposed borrow sites
32	Ascension, Plaquemines, and St. Charles	Potentially excavating all suitable material from seven proposed borrow sites

*S - Supplemental

4.1 REGIONAL ENVIRONMENTAL SETTING

The HSDRRS project area is located between the Lake Pontchartrain shoreline and the Barataria and Breton Sound basins in St. Charles, Jefferson, Orleans, St. Bernard, and Plaquemines parishes. The HSDRRS includes all portions of the Greater New Orleans Metropolitan Area located south of Lake Pontchartrain. The western end of the HSDRRS abuts the Bonnet Carré spillway on the east bank and Bayou Verret near Waggaman on the west bank. The eastern end of the HSDRRS is located in Bayou Sauvage National Wildlife Refuge (NWR) and along the MRGO on the east bank and Hero Canal and the Mississippi River near Belle Chasse on the west bank (see figure 2-1).

The HSDRRS project area has a subtropical climate, with tropical air masses dominating the weather during the spring and summer, and cold continental frontal passages causing substantial temperature changes during the fall and winter. The project area is subject to tropical storm events between June and November. Tropical storm events typically produce the highest wind speeds and greatest rainfall events along the Gulf Coast. Category 5 hurricanes, such as Hurricane Camille, which made landfall just east of New Orleans on August 17, 1969, generate the highest sustained wind speeds in the region (greater than 155 miles per hour). High winds are typically accompanied by massive storm surge, and in the case of Category 5 storms, these surges can be as high as 28 ft when they strike the Louisiana Coast (National Hurricane Center 2010). Between 1926 and 2005, a total of 10 hurricanes struck Orleans Parish (National Hurricane Center 2007). The frequency of hurricanes is greatest between August and October; however, hurricane season extends from June through November (National Hurricane Center 2007). Prior to Hurricane Katrina in 2005, Hurricane Betsy, on September 9, 1965, was the most damaging tropical storm in the Greater New Orleans Metropolitan Area. Hurricane Betsy caused a storm surge of 10 ft, flooding large parts of the city, claiming 81 lives, and causing \$1 billion in damage at the time (NOAA 2007b).

The near-surface geology of the area surrounding the HSDRRS project area can best be explained as the result of a subsiding Mississippi River delta lobe that has been drained, diked, and filled with various types and vintages of dredged material derived from nearby water bodies (e.g., Lake Pontchartrain) and adjacent drainage canals. The deepest formations investigated in the area are Pleistocene deposits, consisting of somewhat hardened fluvial sands, silts, and mud

at a depth of 40 to 60 ft below the ground surface to depths around 180 ft below the ground surface. These sediments were exposed and weathered during low sea-level stands as a result of Pleistocene glaciation, resulting in relatively higher cohesive strengths than would normally be expected. Holocene deposits found above the Pleistocene deposits are the result of gradual deposition of organic peat mixed with fluvial silt and mud deposited as overbank deposits and interdistributary bay deposits of the Mississippi River in cypress swamps around Lake Pontchartrain (Kolb et al. 1975).

The high water content and plasticity of surface soils in the area translates into materials that are easily compressed. Soils in the Pleistocene formation (deeper formations) are of greater strength than those of the overlying Holocene (Kolb et al. 1975). Therefore, when compression occurs on the surface, such as pile driving or movement of large machinery, soil movement can only be lateral.

Much of the HSDRRS project area was formerly wetlands (cypress swamps and marshes). As the Greater New Orleans Metropolitan Area grew and the constructed levees were built ever higher, water was drained from swamps and marshes by canals, and pumped and dredged material, including peat and mud, were used to elevate the area for habitation. Resulting surface soils are classified as dredged material or muck. Land inside the levees is continually subsiding due to dewatering of peat deposits, often resulting in surface elevations below sea level. Water content in the soils is generally high and increases with depth. The near-surface groundwater table is connected to the water level in Lake Pontchartrain; hence, the need for numerous drainage canals and pumps to remove constant groundwater inflow.

Seismicity is generally not a factor in southeast Louisiana. There are numerous small normal growth faults located beneath the City of New Orleans and Lake Pontchartrain, but sudden failure of these faults is not likely. Instead, a gradual slippage has been documented, resulting in general land subsidence on the down side (Gulf of Mexico side) of the faults (Louisiana Geological Survey 2001). Additionally, surface water and groundwater quantity is also not a resource of issue in southeast Louisiana. There is adequate surface water quantity available for all uses in the majority of the region, primarily because surface water for drinking, commercial, and industrial uses is derived from the Mississippi River and its tributaries. Groundwater is typically not extracted in any substantial quantities for residential or commercial use. Although water quantity is not a resource issue in the region, water quality is a significant resource and is described in detail in section 4.2.2.

4.2 IMPORTANT RESOURCES

This section contains a list of the important environmental resources located in the HSDRRS project area, and describes those resources impacted, directly or indirectly, by the HSDRRS. The resources described in this section are those recognized as significant by laws, executive orders (EO), regulations, and other standards of National, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. The affected environment and impacts sections are organized by HSDRRS sub-basin, where possible (see figure 1-2), and when this is not possible, the resource will be discussed by parish or county. For some select resources, such as Threatened and Endangered Species, the affected environment and environmental consequences descriptions are organized to reduce redundancy, and are organized by a resource category instead of organized by sub-basin or parish/county.

Those important resources found within the HSDRRS area and described in one or more IERs as being impacted or not impacted are listed below.

- Soils
- Water Quality

- Wetlands
- Uplands
- Fisheries
- Wildlife
- Essential Fish Habitat (EFH)
- Threatened and Endangered Species
- Cultural Resources
- Recreational Resources
- Aesthetics
- Air Quality
- Noise
- Transportation
- Socioeconomic Resources and Environmental Justice
- HTRW

4.2.1 Soils

4.2.1.1 Affected Environment

NRCS is responsible for identifying and classifying soils in the U.S. NRCS publishes soil surveys that identify soil properties and classifications designed to assist property owners and government officials in determining the best use of soils for a particular project. All physical and chemical properties of soils are identified, as well as the best use of those soils, including agricultural uses.

Prime farmlands are identified by NRCS as those farmland soils that have the best combination of physical and chemical properties to be able to produce fiber, feed, or food, and are available for these uses. Unique farmland is defined as land other than prime farmland that is used for producing specific high-value food and fiber crops. The Farmland Protection Policy Act (FPPA), administered by NRCS, requires Federal agencies to evaluate the effects (direct and indirect) of their activities before taking any action that could result in the conversion of designated prime or unique farmland, or farmland of statewide and local importance, for nonagricultural purposes. If an action would adversely affect farmland preservation, alternative actions that could avoid or lessen adverse effects must be considered. Determination of the level of impact of a project on prime and unique farmland or farmland of statewide and local importance is accomplished by the lead Federal agency (proponent) through an inventory of farmlands affected by the proposed action and completion of a Farmland Conversion Impact Rating for each alternative. In consultation with the proponent, NRCS completes the rating evaluation and determines the level of consideration required for protection of farmlands under the FPPA (NRCS 2010b).

Farmlands subject to FPPA requirements do not have to be currently in use for crop production. The land can be in use as pasture or cropland, forest land, or other wildlife habitat. Areas of water, wetlands, or urbanized land are not considered subject to FPPA requirements. Farmlands previously impacted by development or other hard structures, such that they are no longer viable for crop production, are not regulated under the FPPA.

4.2.1.1.1 Existing Conditions

Soils within the HSDRRS were generally formed from Mississippi River sediments deposited as river floodwaters spread over the river banks during flood events. Soils in the project areas are usually fine-grained sand, silt, and clay and contain abundant organic material.

As such, most soils in the rural project areas support crop production, and many are classified as prime farmland soils as indicated in figure 4-1.

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Figure 4-1: Prime Farmland within the HSDRRS Sub-basins

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The fine-grained composition and high clay content of soils in the project area make the majority of soils suitable for levee construction, and most existing levees were constructed using soils that were excavated from borrow areas in the immediate vicinity.

A list of soils found within the project area, including the borrow sites, can be found in table 4-2. The list was compiled from the current soil classifications available from the NRCS (NRCS 2010a). During the time period involved for the completion of most of the HSDRRS IERs (2006 to 2010), the NRCS has reclassified and renamed some soil series in the southeast Louisiana area. Therefore, the soil series names found in table 4-2 do not correspond with some soil series identified in the IERs developed early in the HSDRRS environmental planning process. In addition, a series of soil maps for the project area is included in appendix M.

Table 4-2. Soils Series Found within the HSDRRS Project Area¹

Soil Series	Soil Properties
Allemands	<ul style="list-style-type: none"> • Clayey, smectitic, euic, hyperthermic Terric Haplosaprists • Very deep, very poorly drained • Rapidly permeable in the organic materials and very slowly permeable in the underlying clay horizons • Slopes are less than 1 percent • Located on the landward side of low coastal freshwater marshes and formed in decomposed herbaceous material over alluvial sediments.
Barbary	<ul style="list-style-type: none"> • Very-fine, smectitic, nonacid, hyperthermic Typic Hydraquents • Very deep, very poorly drained • Very slowly permeable • Slopes are less than 1 percent • These soils formed in recent, slightly fluid to very fluid clayey sediments that have been deposited in water and are continuously saturated and flooded. These soils are mainly on low, broad, ponded back swamps of the lower Mississippi River Alluvial Plain.
Cancienne	<ul style="list-style-type: none"> • Prime farmland soils • Fine-silty, mixed, superactive, nonacid, hyperthermic Fluvaquentic Epiaquepts • Mineral soils • Very deep, level to gently undulating, somewhat poorly drained • Moderately slowly permeable • Slopes range from 0 to 3 percent • These soils formed in loamy and clayey alluvium. They are on high and intermediate positions on natural levees and deltaic fans of the Mississippi River and its distributaries.
Carville	<ul style="list-style-type: none"> • Prime farmland soils • Coarse-silty, mixed, superactive, calcareous, hyperthermic Fluventic Endoaquepts • Formed in recent loamy alluvium • Very deep, somewhat poorly drained • Moderately permeable soils • Slopes range from 0 to 2 percent • These soils are on nearly level to very gently sloping natural levee positions on flood plains, mainly along the Mississippi River and its distributaries.
Clovelly	<ul style="list-style-type: none"> • Clayey, smectitic, euic, hyperthermic Terric Haplosaprists • Very deep, very poorly drained • Very slowly permeable soils • Slopes are less than 1 percent • These soils formed in moderately thick accumulations of herbaceous organic material overlying very fluid clayey alluvial sediments. These soils are on broad coastal marshes that are nearly continuously flooded with brackish water.

Table 4-2, continued

Soil Series	Soil Properties
Fausse	<ul style="list-style-type: none"> • Very-fine, smectitic, nonacid, hyperthermic Vertic Endoaquepts • Formed in clayey alluvium • Very deep, very poorly drained • Very slowly permeable soils • Slopes are less than 1 percent • These soils are in low, ponded back swamp areas of the lower Mississippi River alluvial plain.
Gentilly	<ul style="list-style-type: none"> • Fine, smectitic, nonacid, hyperthermic Typic Hydraquepts • Slightly to moderately saline soils • Very deep, very poorly drained • Very slowly permeable • Slopes are less than 1 percent • These soils formed in thin accumulations of herbaceous plant remains and semi-fluid clayey alluvium over consolidated clayey deposits.
Gramercy	<ul style="list-style-type: none"> • Prime farmland soils • Fine, smectitic, hyperthermic Chromic Epiaquepts • Very deep, poorly drained • Very slowly permeable • Slope is predominantly less than 0.5 percent, but ranges to 3 percent • These soils formed in clayey over fine-silty alluvium and are on alluvial flats and on the lower parts of natural levees on the alluvial plain of the Mississippi River and its distributaries.
Harahan	<ul style="list-style-type: none"> • Prime farmland soils • Very-fine, smectitic, nonacid, hyperthermic Vertic Endoaquepts • Very deep, poorly drained • Very slowly permeable soils • Slopes range from 0 to 1 percent • They formed in moderately thick firm clayey alluvium overlying fluid clayey sediments. These soils are on broad back swamp positions on the lower Mississippi River flood plain. • These soils are protected from flooding by levees, and are artificially drained by pumps.
Kenner	<ul style="list-style-type: none"> • Euic, hyperthermic Fluvaquentic Haplosaprists • Organic soils • Very deep, very poorly drained • Very slowly permeable • Slopes are less than 1 percent • These soils formed in herbaceous plant remains stratified with clayey alluvium. They are in freshwater marshes along the Gulf of Mexico.
Lafitte	<ul style="list-style-type: none"> • Euic, hyperthermic Typic Haplosaprists • Organic soils • Formed in herbaceous plant remains over mineral sediments • Very deep, very poorly drained • Moderately rapidly permeable • Slopes are less than 1 percent • These soils are in intermediate and brackish marshes in the extreme lower Mississippi River Delta and coastal areas.

Table 4-2, continued

Soil Series	Soil Properties
Larose	<ul style="list-style-type: none"> • Very-fine, smectitic, nonacid, hyperthermic Typic Hydraquents • Formed in fluid clayey sediments in freshwater coastal marshes • Very deep, very poorly drained • Very slowly permeable • Slopes are less than 1 percent • The sediments were deposited under water and have never air-dried and consolidated. These soils are subject to flooding by runoff and tides.
Schriever	<ul style="list-style-type: none"> • Prime farmland soils • Very-fine, smectitic, hyperthermic Chromic Epiaquents • Formed in clayey alluvium • Very deep, poorly drained • Very slowly permeable soils • Slope is predominantly less than 1 percent, but ranges up to 3 percent • These soils are located on the lower parts of natural levees and in back swamp positions on the lower Mississippi River alluvial plain.
Rita	<ul style="list-style-type: none"> • Very-fine, smectitic, nonacid, hyperthermic Vertic Endoaquents • Found in freshwater coastal marshes that have been protected from flooding by a system of levees and pumps • Very deep, poorly drained, • Very slowly permeable soils • Slopes are less than 1 percent • These soils formed in a thin layer of herbaceous organic material overlying semi-fluid clayey sediments that dried and consolidated in the upper part as the result of artificial drainage. Most of the organic material has oxidized since drainage.
Vacherie	<ul style="list-style-type: none"> • Prime farmland soils • Coarse-silty over clayey, mixed over smectitic, superactive, nonacid, thermic Aeric Fluvaquents • Formed in silty and clayey alluvium • Deep, somewhat poorly drained • Very slowly permeable soils • Slopes range from 0 to 3 percent • These soils are on nearly level to very gently sloping flood plains of the Mississippi River.
Westwego	<ul style="list-style-type: none"> • Very-fine, smectitic, nonacid, thermic, cracked Thapto-Histic Fluvaquents • Deep, poorly drained • Very slowly permeable soils • Slopes are less than 1 percent • They formed in semi-fluid clayey alluvium and organic material that dried and shrank irreversibly in the upper part as the result of artificial drainage. These soils are on broad, drained former swamps along the lower Mississippi River and its tributaries. These soils are protected from flooding by a system of levees and are artificially drained by pumps.

Source: NCRS 2010a.

¹ The portion of the HSDRRS described by NEPA Alternative Arrangements.

4.2.1.2 Impacts of HSDRRS Projects

4.2.1.2.1 HSDRRS 2011 Impacts

Soil impacts are generally defined as the change in land use of an area such that the soils in the area are no longer suitable for their best use, or the construction of facilities or structures on soils that cannot support the facilities or structures due to soil instability. The urban areas affected by the HSDRRS contain soils that have previously been impacted by development, constructed levees, and other risk reduction structures. HSDRRS impacts on prime farmland soils, which are

relatively undisturbed, were both adverse due to a permanent loss of the soils and beneficial due to a reduction in risk of future flooding.

The impacts due to construction of additional risk reduction structures and expansion of existing levees in these urban areas had little adverse effect on previously disturbed soils. Areas within the HSDRRS that are designated prime farmland soils are beneficially impacted by the HSDRRS, as the land used as farmland, rangeland, forestland, and wildlife habitat has a reduced risk of flooding.

All borrow sites, except for the Maynard site in the New Orleans East sub-basin, were generally located in rural areas and often at agricultural land use sites. A total of 48 borrow sites contain prime farmland soils, as classified by the NRCS (appendix M). Of these, 17 borrow sites—one in the New Orleans East sub-basin, 10 in the Chalmette Loop sub-basin, and six in the Lake Cataouatche sub-basin—were located within the HSDRRS project area.

Table 4-3 identifies the acreage of prime farmland soils estimated to be impacted by the HSDRRS, shown by sub-basin. The impacts on prime farmland soils are anticipated to be much greater from potential borrow site excavation (as much as 5,129.7 acres; this total amount is estimated from the Borrow IERs) than from construction of risk reduction projects (approximately 51.6 acres) (see appendix M). The loss of prime farmland soils would result in a major impact on soils in the New Orleans East, Chalmette Loop, Belle Chasse, and Lake Cataouatche sub-basins. The impact on soils from HSDRRS construction and conversion of soils to open water at borrow sites would result in a minor impact on soils in the other sub-basins. Removing soils from borrow areas resulted in a permanent loss of prime farmland soils, and the areas are no longer available for pasture or farmland use. Upon completion of excavation activities, borrow areas likely naturally filled with water and were converted to ponds or small lakes, or refilled with overburden or unusable soils. Borrow areas that retain water would not be used again to produce crops or provide forage for herbivores, such as deer, rabbits, or cattle.

The potential loss of as much as 5,181.3 acres of prime farmland soils is a major impact for southeast Louisiana and the region (see table 4-3). Although this is a worst-case scenario that assumes all borrow sites would be excavated, the estimate of impact constitutes a loss of approximately 5.0 percent of all prime farmland soils regionally (see table 4-3). Because the loss of these prime farmland soils is permanent and will result in a substantial reduction in the available productive farmland regionally, the loss of prime farmland soils is a significant impact. No mitigation measures can be implemented that would reduce the level of impact.

However, in evaluating the impacts on soils regulated under the FPPA, consideration is given to the relative value of the impacted soils as agricultural land versus the alternative use proposed. Of the 48 borrow sites that contain prime farmland soils, only 25 were, or had been in the recent past, used for pasture, farmland, or timber production (see appendix M). The use of the excavated prime farmland soils from borrow sites for HSDRRS construction provides a benefit to the Greater New Orleans Metropolitan Area, and provides a reduction in risk of flooding undisturbed farmlands within the HSDRRS.

Table 4-3. Total Prime Farmland Soils Impacted by the HSDRRS Risk Reduction and Borrow Projects

HSDRRS Sub-basin	Total Prime Farmland Soils in HSDRRS Sub-basin ¹ (acres)	Prime Farmland Soils impacted from HSDRRS Risk Reduction Projects (acres)	Prime Farmland Soils potentially impacted from HSDRRS Borrow Projects (acres)	Total potentially impacted Prime Farmland Soils from HSDRRS Projects (acres)	Percent of Prime Farmland Soils potentially impacted
St. Charles	254.7	0.0	0.0	0.0	0.0
Jefferson East Bank	0	0.0	0.0	0.0	0.0
Orleans East Bank	0	0.0	0.0	0.0	0.0
New Orleans East	0	0.0	29.7	29.7	100.0
Chalmette Loop	3,182.2	11.2	441.3	452.5	14.2
Belle Chasse	19.0	6.4	0.0	6.4	33.7
Gretna-Algiers	0	0.0	0.0	0.0	0.0
Harvey-Westwego	0	0.0	0.0	0.0	0.0
Lake Cataouatche	2,011.7	34.0	559.4	593.4	19.8
Total HSDRRS Sub-basin Total	5,467.6	51.6	1,030.4	1,087.9	5.0
Total Outside HSDRRS Sub-basin²	98,265.0	N/A	4,099.3	4,099.3	4.2
TOTAL³	103,733.6	51.6	5,129.7	5,181.3	5.0

¹Quantifications for Total Prime Farmlands Soils in HSDRRS sub-basin (acres) include all NRCS prime farmland soils and farmland of statewide importance.

²Impacted acres of prime farmland from borrow site excavation outside the sub-basins were quantified in IERs #19, #22, #23, #25, #26, #28, #30, and #31 and totaled approximately 2,333.79 acres. IERs #29, #31, and #32 did not quantify impacted acres of prime farmland from borrow site excavation activities, but did state prime farmland would be impacted at the Acosta 2, Idlewild Stage 2, Searsdale, Kings Mine, Port Bienville, Lilly Bayou, Raceland Raw Sugar, River Birch Landfill Expansion, Willow Bend Phase II, Tammany Holding Corporation, Bocage, Citrus Lands, Conoco Phillips, Idlewild Stage 1, Narin, Plaquemines Dirt & Clay, and 3C Riverside Phase 3 sites. Gulf South Research Corporation (GSRC) quantified the maximum amount of prime farmland soils that were potentially impacted at these borrow sites using NRCS prime and unique farmland soils mapping; approximately 2,759.16 acres of farmland outside the sub-basins could be impacted from the borrow site excavation activities described in IERs #29, #31, and #32. (For a complete list of impacted prime farmland soils acres at each borrow site, see Prime Farmland Soils Data in appendix M).

³The total percent of prime farmland soils impacted was quantified using the total acres impacted and the total acres of prime and unique farmland soils both within and outside the sub-basins. The percent of all prime and unique farmland soils impacted within each sub-basin was quantified using the total acres impacted and the total area of prime and unique farmland soils specific to each sub-basin. Thus, the total percent impacted does not equal the total sum of the percent impacted within each sub-basin.

4.2.1.2.2 HSDRRS 2057 Impacts

Short-term construction-related impacts due to future levee lifts, armoring, and soil stabilization would include soil loss through water and wind erosion, compaction, and loss of biological productivity. Exposed soil during construction would be unstable and susceptible to wind and water erosion. Eroded soils from construction sites could damage adjacent vegetation by coating leaf surfaces and limiting transpiration and photosynthesis, and disturb adjacent wetlands communities through increased suspended solids in the water column, which reduces light penetration and decreases overall water quality. These impacts could be minimized by implementing mitigation efforts such as best management practices (BMPs) as described by Stormwater Pollution Prevention Plans (SWPPP) at the levee lift construction sites.

After construction, the disturbed soils would stabilize and revegetate. Soils would also be impacted by compaction at the construction sites and loss of biological productivity. Structurally, levee soils must be compacted to provide adequate support against the pressure produced by high floodwaters. Compacted soils are less productive than aerated, loamy soils, so the vegetation available on levees following construction may not be the same species that are available at preferred wildlife habitats. Mitigation efforts implemented by the USACE to minimize soil impacts are discussed in section 5.0. It is likely that some soils designated as prime farmland soils would be used for future levee lifts. Due to the volume of prime farmland soils already removed for HSDRRS construction, the removal of prime farmland soils from borrow areas regionally would be a major impact and would be a significant loss of prime farmland soils.

4.2.1.3 Cumulative Impacts

4.2.1.3.1 Cumulative Impacts for HSDRRS 2011 and HSDRRS 2057

There would be significant permanent, major cumulative impacts on soils from the construction of risk reduction efforts and the removal of borrow materials. The magnitude of cumulative impacts on soils would be greater for the borrow sites than for construction of HSDRRS components. Soils removed from borrow sites for HSDRRS construction and for future levee lifts occur primarily in rural areas and result in thousands of acres that are no longer suitable for pasture or farmland uses. Adverse cumulative impacts are greatest in Jefferson, Plaquemines, and St. Bernard parishes, as there are eight borrow areas containing prime farmland soils in Jefferson Parish, 12 in Plaquemines Parish, and 13 in St. Bernard Parish (see appendix M).

Long-term cumulative beneficial impacts on soils would result from the implementation and maintenance of the HSDRRS. All soils within the HSDRRS would have a lower risk of inundation from storm events, including prime farmland soils, which could continue to be used for agricultural production during major storm events. Further, with the reduced risk of storm surge, it would be less likely for crop destruction to occur from flooding or brackish water inundation.

The HSDRRS could also have a minor adverse cumulative impact on soils due to the potential for induced development in the project area as flooding risk for properties is reduced. Development pressures often result in encroachment into rural agricultural lands, and with more development comes an increase in the use of impervious surfaces such as roads, homes, and parking areas. Impervious surfaces increase the flow of migrating rainwater and increase the erosion of exposed soils. Increased development in the HSDRRS project area would remove soils from biological productivity, and permanently remove prime farmland soils from agricultural production.

4.2.1.3.2 Cumulative Impacts of Present and Future Regional Actions

Other regional future and present actions would also continue to change land use patterns and would contribute to the cumulative loss of prime farmland soils in southeastern Louisiana. Over the past 300 years, portions of southeastern Louisiana have been reclaimed by the use of levees, floodwalls, and forced drainage. Areas containing prime farmland soils in southeastern Louisiana have historically been affected by conversion from residential, commercial, and industrial development in a significant portion of the leveed areas in the region, and it is anticipated that this historical trend would continue to impact prime farmland soils in the region. As more flood risk reduction projects are implemented regionally, additional borrow would be required to increase levee heights, expand levee lengths, and provide a higher level of risk reduction.

Storm Damage Reconstruction

Most reconstruction projects occur within the footprints of former structures and, therefore, would have no cumulative impact on soils. Further, where reconstruction occurs beyond the footprint of original structures, it typically only impacts highly modified or previously disturbed soils in urban areas.

Redevelopment

Private redevelopment projects in urbanized areas of southeast Louisiana would have no cumulative impacts on soils due to the previously disturbed nature of these areas. However, redevelopment in rural areas would likely cause a cumulative adverse impact on soils, especially through the additional loss of prime farmland soils. Risk reduction provided by the HSDRRS could induce development on rural farmland, causing a minor indirect impact on soils.

Coastal and Wetlands Restoration

Generally, the soils associated with coastal and wetlands restoration projects (either at the location of restoration, or in areas where soils are removed for beneficial uses) would not be classified as prime farmland soils, and the introduction of any soils to raise the elevation of open water habitats to create and restore wetlands would provide beneficial effects on soils. Therefore, no cumulative adverse impacts would occur on soils from restoration projects regionally.

Flood Risk Reduction Projects

Flood risk reduction projects have direct impacts through loss of biological productivity of soils under the footprint of new structures and from the removal of soils as borrow material, some of which would likely include prime farmland soils in the region. Long-term maintenance of levees through additional lifts would further impact soils in borrow areas. It is reasonable to anticipate that borrow material would be needed for a majority of these projects, and prime farmland soils would likely be impacted during construction. Removal of soils for levee construction projects would contribute to the overall loss of farmland soils in southeastern Louisiana. Flood risk reduction efforts have a beneficial impact on the area's farmland soils as well. Further, risk reduction projects like the HSDRRS reduce the likelihood of soil and nutrient enrichment from seasonal flooding. Without soil enrichment from natural flooding, subsidence occurs in alluvial areas.

4.2.1.3.3 Summary of All Cumulative Impacts for Soils

Cumulatively, past, ongoing, and future projects in the region would result in the cumulative loss of biological productivity of soils and the potential for cumulative indirect impacts on soils through erosion and stormwater runoff as the area of impermeable surfaces increases. A major cumulative impact on prime farmland soils in the region is anticipated as borrow sites are

utilized for flood risk reduction projects, and induced development converts agricultural lands to residential and commercial development.

Beneficial cumulative impacts on soils would occur from coastal and wetlands restoration projects as healthier marsh and forested wetlands are created and protected and to some degree are able to trap sediments, sustain vegetation, and build new rich organic soils. Additionally, healthier marshes would act as a buffer for storm surge and could provide beneficial impacts on prime farmland soils further inland. Flood risk reduction projects would also provide beneficial impacts due to the reduction of storm surge inundation through increased hurricane surge protection.

4.2.2 Water Quality

4.2.2.1 Affected Environment

The major water bodies in the HSDRRS project area are Lake Pontchartrain, Lake Borgne, Lake Cataouatche, Lake Salvador, and the Mississippi River. Prior to modern development, water quality in the project area was influenced by natural phenomena such as severe weather events and shifts in river and estuarine systems. The first major public water quality concern in the region in the 19th century was the presence of bacterial pathogens in the water supply, streets, and public facilities. In the 20th century, the region faced a number of other water quality concerns that demanded attention, such as hydro-modification (i.e., alteration of natural drainage features by human activity, such as the construction of levees) of the Mississippi River and other water bodies, industrial point sources, faulty septic and sewer systems, stormwater runoff, non-point source pollution from agriculture, construction projects, forestry, gravel mining, and the development of urban areas (Louisiana Department of Environmental Quality [LDEQ] 2000).

4.2.2.1.1 Existing Conditions

The Mississippi River flows approximately 2,333 miles from Lake Itasca in northern Minnesota to its terminal delta at the Gulf of Mexico in southeast Louisiana. The Mississippi River watershed is the world's second largest, draining approximately 1.83 million square miles, including tributaries from 32 U.S. states and two Canadian provinces. The Mississippi River watershed encompasses 40 percent of the contiguous U.S. Lake Pontchartrain, a large, brackish shallow estuary located north of the HSDRRS, receives freshwater from various lakes, rivers, bayous, and canals, while receiving salt water from the Gulf of Mexico. Lake Borgne, is also a shallow estuary, and is located to the east of the project area. Lake Borgne receives flows from the Pontchartrain Basin and drains directly into Mississippi Sound. Lake Salvador is located southwest of the project area in the Barataria Basin in Jefferson, Lafourche, and St. Charles parishes. Lake Salvador is connected to Lac des Allemands to the west by Bayou Des Allemands and Lake Cataouatche to the north, and by Bayou Couba and Bayou Bardeaux. Various waterways within the HSDRRS project area are shown in figure 4-2.

Section 303(d) of the CWA requires that states develop a list of waters that do not meet water quality standards and do not support their designated uses. In response to this mandate, LDEQ has prescribed water quality standards for surface waters within the State of Louisiana in order to promote a healthy and productive aquatic system. Surface water standards are set to protect the quality of all waters of the state, including rivers, streams, bayous, lakes, reservoirs, wetlands, estuaries, and many other types of surface water. Standards apply to pH, temperature, bacterial density, dissolved oxygen (DO), chloride concentration, sulfate concentration, and total dissolved solids (TDS). Designated Uses are activities or conditions that water resources can sustain, such as Primary Contact Recreation (PCR), which includes swimming and water skiing, and Secondary Contact Recreation (SCR), which includes boating and sailing.



Figure 4-2: Waterways within and adjacent to the HSDRRS Project Area

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Fish and Wildlife Propagation includes ecological conditions that are conducive to the propagation of aquatic organisms and are measured by water quality parameters that affect the health of fish and wildlife, such as the concentration of DO, TDS, and nutrients. Additionally, there is a designated use for oyster propagation, which includes a standard for bacteria levels and one for drinking water, that sets criteria for levels of bacteria and a number of different metals and toxins (LDEQ 2006).

The HSDRRS risk reduction projects are located in several LDEQ sub-watersheds (figure 4-3), most of which are on the LDEQ Water Quality Inventory Integrated Report (Section 305(b) and 303(d)) list for 2006 for violating pollution criteria. Several of the water bodies in the project area are impaired because of low DO levels and high fecal coliform bacteria counts. Many of the water bodies have concentrations of dissolved solids, copper, chloride, and phosphorus that exceed water quality standards (LDEQ 2006).

Attainment standards are the numerical criteria to ensure that Louisiana's waterways maintain safe levels for human health, propagation of fish and wildlife, and maintenance of recreational uses. Table 4-4 presents the water quality attainment status, designated uses that are in non-attainment, water quality impairments, suspected causes of impairment, and suspected sources of impairments of the LDEQ sub-watersheds associated with the IERs included in the HSDRRS.

4.2.2.2 Impacts of HSDRRS

4.2.2.2.1 HSDRRS 2011 Impacts

HSDRRS construction activities modified the surface hydrology, increased turbidity, decreased DO, increased suspended sediments, and potentially caused a slight increase in water temperature. As part of the National Pollutant Discharge Elimination System (NPDES) permit process, a General Stormwater Permit was required prior to all HSDRRS construction activities, which included a site-specific SWPPP and a Notice of Intent. Stormwater runoff from the construction sites and staging areas and dredging for construction access to select HSDRRS structures had direct short-term impacts on water quality. Although SWPPPs were prepared for all HSDRRS construction work, SWPPPs were not prepared by the CEMVN for borrow site use; instead, the preparation of SWPPPs and implementation of BMPs were the responsibility of the construction contractors, who were required to follow all local, state, and Federal regulations for stormwater discharges.

All USACE contractors needed a site-specific Spill Prevention, Control and Countermeasure Plan (SPCCP) in place prior to the start of construction. During construction activities, only two reportable spills occurred that involved regulated waste. The first occurred in Jefferson Parish at Pump Station Westwego #2 in March 2011. An unknown amount of diesel fuel was discharged into the Keyhole Canal at the pump station. Because the amount of fuel discharged was unknown, the impacts on water quality are not entirely known; however, it is believed that the spill was small in size, rapidly dispersed, and did not permanently impact water quality. The second spill occurred in Plaquemines Parish at the Planters Pump Station in February 2011. Approximately 2 gallons of biodegradable hydraulic grade vegetable oil was discharged into the Algiers Canal. The area was protected by an oil boom, and no material was discharged off-site. Thus, water quality was not impacted by the spill. In addition to the two larger spills, two other minor spills were reported during construction of LPV-144 and LPV-146 that involved biodegradable hydraulic vegetable-based fluid. The spills were cleaned up immediately and no impacts on water quality occurred as a result of these spills.

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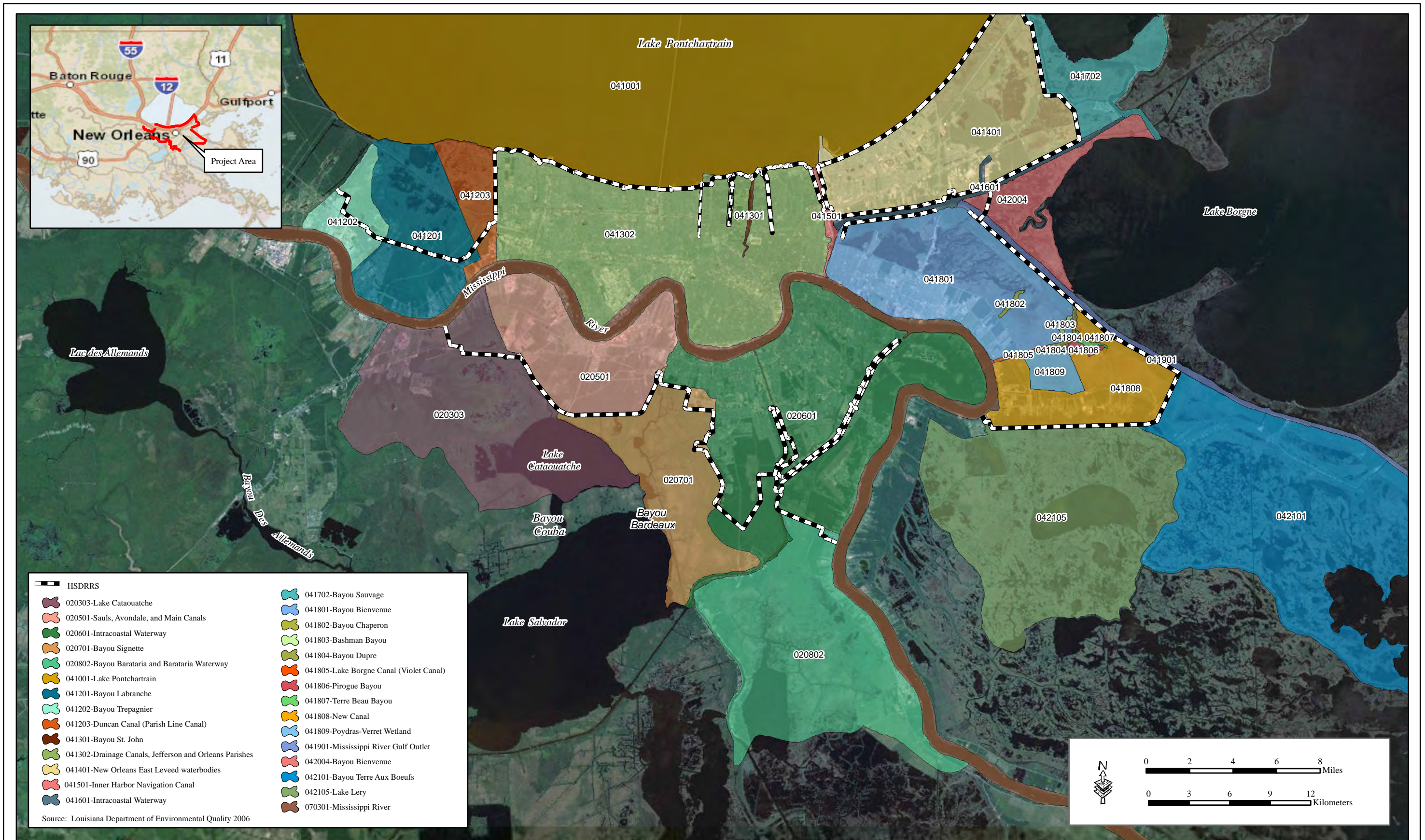


Figure 4-3: LDEQ Sub-watersheds within and adjacent to the HSDRRS Project Area

Table 4-4. LDEQ Sub-Watersheds in Project Area and Suspected Causes of Impairments

Sub-basin/Parish/County	IER* #	Sub-watershed Name	LDEQ ID #	Water Quality Attainment Status	Suspected Causes of Impairment	Suspected Sources of Impairment
St. Charles	1, S 1	Bonne Carré Spillway	041101	Fully Supporting All Designated Uses	NA	NA
St. Charles	1, S 1	Bayou Trepagnier	041202	Not Supporting FWP	Dissolved Copper	Sources Unknown
St. Charles	1, S 1	Bayou LaBranche	041201	Not Supporting FWP	Low DO Nitrite/Nitrate Total Phosphorus	Forced Drainage Pumping Natural Sources
St. Charles	1, S 1, 2, S 2	Duncan Canal	041203	Not Supporting FWP	Dissolved Copper	Sources Unknown
Jefferson Parish East Bank	2, S 2, 3, S 3.a	Drainage Canal Jefferson Parish	041302	Not supporting PCR and SCR	Fecal Coliform	Municipal Sanitary Sewer Overflows (Collection System Failures)
Orleans East Bank	4	Bayou St. John	041301	Fully Supporting All Designated Uses	NA	NA
New Orleans East	6, S 6, 7, S 7, 18, 19, 25, 28	New Orleans East Leveed Water bodies	041401	Not Supporting PCR, SCR, and FWP	Fecal Coliform Low DO	Municipal Sanitary Sewer Overflows
New Orleans East	7, S 7	Bayou Sauvage	040702	Fully Supporting All Designated Uses	NA	NA
New Orleans East	7, S 7, 11, 12, S 12, 13, 14, S 14.a	Intracoastal Waterway	041601	Not Supporting Oyster Propagation	Fecal Coliform	Source Unknown
Chalmette Loop	8, 9, 10, 18, 30	Bayou Bienvenue	041801	Fully Supporting All Designated Uses	NA	NA
Chalmette Loop	8, 10, 28	Bayou Dupre	041808	Fully Supporting All Designated Uses	NA	NA
Chalmette Loop	9	Lake Lery	042105	Not Supporting Oyster Propagation	Fecal Coliform	Source Unknown
Chalmette Loop	10,18, 19	New Canal	041808	Fully Supporting All Designated Uses	NA	NA
Chalmette Loop	11 Tier 2 Pontchartrain and Borgne, S 11 Tier 2 Borgne	Mississippi River Gulf Outlet	041901	Not Supporting Oyster Propagation	Fecal Coliform	Source Unknown
Belle Chasse	13, 23, 32	Bayou Barataria and Barataria Waterway	020802	Fully Supporting All Designated Uses	NA	NA
Belle Chase	18, 22	Intracoastal Waterway	020601	Not Supporting PCR	Fecal Coliform	Marina/Boating Sanitary Discharges
Lake Cataouatche	14, S 14.a, 15, 17	Bayou Segnette	020701	Fully Supporting All Designated Uses	NA	NA
Lake Cataouatche	15, 17,18, 19, 25, 26, 31	Sauls, Avondale, and Main Canals	020501	Not Supporting PCR and FWP	TDS Fecal Coliform	Municipal Point Source Discharges, Sewage
Lake Cataouatche	15, 17	Lake Cataouatche	020303	Not Supporting FWP	Chloride, TDS	Drought-related Impacts
Lake Cataouatche	10, 16, S 16.a	Mississippi River	070301	Fully Supporting All Designated Uses	NA	NA
Plaquemines Parish	18, 22, 25, 32	Bays Bastian, Adam, Scofield, Coquette	021001	Fully Supporting All Designated Uses	NA	NA
St. Bernard Parish	18, 31	Bayou Terre Aux Boeufs	042101	Not Supporting Oyster Propagation	Fecal Coliform	On-site Treatment Systems
Hancock County, Mississippi	19, 23, 26, 30, 31	Wilkinson	0471	Not Supporting FWP	Biological Impairment	Unknown
Iberville Parish	19	Bayou Manchac	040201	Not Supporting PCR, SCR, and FWP	Fecal Coliform Chloride, Nitrate/ Nitrite, DO, TDS,	Sanitary Sewer Overflow and Site Clearance
Plaquemines Parish	19, 22, 26, 28, 31	River Aux Chenes (Oak River)	042102	Not Supporting PCR	Fecal Coliform	Sanitary Sewer Overflow and Site Clearance
St. Charles Parish	23, 26, 29	Lac des Allemands	020202	Not Supporting FWP	DO	Internal Nutrient Recycling, Agricultural Production
St. John the Baptist Parish	29, 31	Lac des Allemands	020202	Not Supporting FWP	DO	Internal Nutrient Recycling, Agricultural Production
St. Tammany Parish	29	Grand Lagoon	040911	Fully Supporting All Designated Uses	NA	NA
St. Tammany Parish	31	W-14 Main Diversion Canal	040909	Not Supporting PCR and SCR	Fecal Coliform	Sanitary Sewer Overflow
St. James Parish	30	Blind River	040403	Not Supporting FWP	Mercury	Atmospheric Deposition
Ascension Parish	32	New River	040404	Not Supporting PCR, SCR, and FWP	Fecal Coliform, DO	Sanitary Sewer Overflow and Site Clearance
Plaquemines Parish	32	Bayou Barataria and Barataria Waterway	020802	Fully Supporting All Designated Uses	NA	NA
Plaquemines Parish	32	Bays Bastian, Adam, Scofield, Coquette	021001	Not Supporting PCR, SCR, and FWP	Mercury, DO, Phosphorus, Nitrate/Nitrite	Land Development
East Baton Rouge Parish	31	Thompson Creek	070502	Not Supporting PCR	Fecal Coliform	On-site Treatment Systems and Septic Systems
Lafourche Parish	31	Bayou Des Allemands	020301	Fully Supporting All Designated Uses	NA	NA

Key: FWP = Fish and Wildlife Propagation, PCR = Primary Contact Recreation, SCR = Secondary Contact Recreation, NA = Not Applicable, *S – Supplemental

Other impacts on water quality occurred from the displacement of water bodies by fill materials, dredging activities and material stockpiling, hydro-modification, and the introduction of impervious surfaces. Specific impacts of the HSDRRS are described below, and these impacts are summarized in table 4-5. This information was compiled from the individual IERs and the 404(b)(1) evaluation permits that were prepared for each IER. Water quality certification pursuant to Section 401 of the Clean Water Act was achieved for each IER. All appropriate and practicable steps were taken, through application of the recommendations of 40 CFR Part 230, Subpart H, 230.70 – 230.77, to minimize adverse effects of the discharge for all the HSDRRS construction activities. Any specific BMPs that were implemented are discussed in section 5.2.

Table 4-5. Summary of HSDRRS 2011 Water Quality Impacts on the HSDRRS Sub-basins¹

Sub-basin/ Parish/ County	IER* #	Summary of the HSDRRS Sources of Water Quality Impairment	HSDRRS Causes of Impairment	Magnitude of Permanent Impacts
St. Charles	1, S 1	Hydro-modification, dredging activities, levee expansion, and construction stormwater runoff.	Levee fill materials; suspended sediments from dredging; stormwater runoff of sediment and miscellaneous construction discharges.	Moderate
Jefferson East Bank	2, 3, S 2, S 3.a	Dredging activities, levee expansion and construction stormwater runoff.	Suspended sediments from dredging activities and stockpile materials; levee fill materials from expansion of levee; and stormwater runoff of sediment and miscellaneous construction discharges.	Moderate
Orleans East Bank	4, 5, 27	Construction stormwater runoff, levee expansion	Increased impervious surfaces; stormwater runoff of sediment and miscellaneous construction discharges.	Minor
New Orleans East	6, S 6, 7, S 7, 11 Tier 2 Pontchartrain, 11 Tier 2 Borgne, S 11-Tier 2 Borgne	Hydro-modification, levee expansion, dredging activities, construction stormwater runoff, impervious surfaces	Suspended sediments from dredging activities, unwatering/watering from cofferdams, and stockpile materials; levee fill materials from expansion of levee; and stormwater runoff of sediment and miscellaneous construction discharges.	Moderate
Chalmette Loop	8, 9, 10, 18, 19, 28, 30	Hydro-modification construction stormwater runoff; levee expansion	Suspended sediments from levee fill materials during expansion of levee; and stormwater runoff of sediment and miscellaneous construction discharges.	Moderate

Table 4-5, continued

Sub-basin/ Parish/ County	IER* #	Summary of the HSDRRS Sources of Water Quality Impairment	HSDRRS Causes of Impairment	Magnitude of Permanent Impacts
Belle Chasse	13, 18, 22	Hydro-modification, dredging activities, construction stormwater runoff; levee expansion	Suspended sediment from dredging activities; suspended sediments from levee fill materials during expansion of levee; and stormwater runoff of sediment and miscellaneous construction discharges.	Minor
Gretna-Algiers	12, S 12	Hydro-modification, dredging, construction stormwater runoff.	Suspended sediments from dredging activities and stockpile materials; levee fill materials from expansion of levee; and stormwater runoff of sediment and miscellaneous construction discharges.	Moderate
Harvey Westwego	14, S 14.a	Hydro-modification, levee expansion and construction stormwater runoff.	Suspended sediments from hydro-modification, and stormwater runoff of sediment and miscellaneous construction discharges.	Minor
Lake Cataouatche	15, 16, S 16.a, 17, 18, 22, 25, 26, 28	Hydro-modification, dredging activities, levee expansion, and construction stormwater runoff.	Suspended sediments from hydro-modification and dredging activities; stormwater runoff of sediment; and miscellaneous construction discharges.	Moderate
Areas Outside of the HSDRRS sub-basins	18, 19, 22, 23, 25, 26, 28, 29, 30, 31, 32	Borrow pit hydro-modification and construction stormwater runoff.	Suspended sediments from hydro-modification and stormwater runoff of sediment and miscellaneous construction discharges.	Negligible

*S - Supplemental

** IERs #6 and 7 dredging work did not occur for the HSDRRS 2011 but would potentially occur with the HSDRRS 2057 work.

¹ The portion of the HSDRRS described by NEPA Alternative Arrangements

Displacement of Water Bodies with Fill Materials

There were several HSDRRS reaches where the base of the earthen levee was expanded or the levee realignment was redirected into open water of a bayou or lake. These actions temporarily impacted water quality through increased sedimentation during construction activities, but impacts on water quality ceased once the levee material stabilized and was armored. Where active concrete pours occurred adjacent to or within water bodies for armoring to protect against erosion and scour, temporary minor impacts on water quality occurred.

Dredging Activities and Material Stockpiling

Dredging activities and stockpiling of dredged materials cause a temporary increase in suspended sediments in the water column. Increased suspended sediments leads to increased turbidity and consumption of dissolved oxygen, and affected aquatic organisms, and has a major temporary impact on water quality. Watersheds within the HSDRRS project area rest on an alluvial plain where soils are composed of silty loams and clays. Organic matter attaches to the clay and silt,

and creates an oxygen demand as the particles decompose within the waterway. This layer of muck creates what is commonly referred to as sediment oxygen demand (SOD). Nutrients in the sediments encourage the growth of macro-algae and nitrifying bacteria. Composed largely of particles of organic material attached to sediments, feces, dead algae, and decaying plant matter, the accumulated sediments can dominate oxygen dynamics. Both winter and summer fish-kills in natural systems caused by oxygen depletion can be attributed to oxygen consumption by sediments (LDEQ 2000).

Dredging likely caused scouring in some areas of waterways and redeposition of sediments across a larger area. The process would have potentially disturbed the benthic organisms by blanketing the water bottom with sediments.

Hydro-modification

Channelization activities increase soil erosion over the long term, adversely impacting water quality. Other minor long-term impacts from hydrologic modification potentially occurred where the HSDRRS realigned the course of channels and permanently dredged maintenance and construction access channels.

Impervious Surfaces

The HSDRRS increased the amount of impervious surfaces on formerly undeveloped landscapes, causing a minor long-term impact on water quality. This decreased the surface area that can capture and absorb rainfall, which resulted in a larger percentage of rainfall runoff during a storm event. In addition, runoff reaches the water bodies much more efficiently, so peak discharge rates are now potentially higher for an equivalent rainfall event. The addition of impervious surfaces in a watershed increases the overland flow rate of stormwater and causes sheet and rill erosion as precipitation flows over land to local streams and water bodies. More runoff and faster flows to water bodies causes bed and bank erosion in bayous and channels.

Specific Impacts of the HSDRRS

In general, several impacts occurred on water quality that were common to all sub-basins. Where wetland fill occurred, filling of wetlands permanently eliminated the affected wetlands' ability to perform water quality functions, causing a major permanent impact on water quality. Fill material that was used for levee construction was all clean fill that was determined in advance to be free of contaminants that would adversely affect water quality. Therefore, no adverse impacts on the water column occurred. Additionally, to help alleviate some water column impacts during construction, construction-related runoff into the wetlands and open water would have been managed by construction contractors through implementation of BMPs and a SWPPP.

St. Charles Sub-basin

Moderate adverse impacts occurred on water quality. The placement of fill material into the water column during construction likely temporarily decreased DO levels in the waters immediately surrounding the construction site by inhibiting photosynthesis of phytoplankton and SAVs or promoting solar heating (IER #1). Also, some particles could contain chemically reduced substances (e.g., sulfides), which have a high chemical oxygen demand, while other particles may have microorganisms attached, which could decompose organic matter and create a biological oxygen demand (BOD). Thus, a localized and temporary reduction in DO potentially occurred in the immediate areas of discharge. Oxygen levels likely returned to normal soon after construction. Excessive turbidity potentially led to temporary increased water temperatures. Increased suspended solids produced during construction could absorb incident solar radiation and slightly increase the temperatures of water bodies, especially near the surface. However, these effects were temporary and occurred only during construction and ended after cessation of construction actions.

Due to the general nature of the historic disposal of oil refinery waste in Bayou Trepagnier, it was anticipated that sediment contamination could be present in the project vicinity (IER #1). In addition, stormwater runoff from the protected side of the Cross Bayou drainage structure potentially facilitated the migration of contaminants into sediments for the HSDRRS dredging. However, the surface elevation of the project region for excavation is above the normal water line of the adjacent canal; therefore, it was not expected that stormwater from the drainage structure resulted in contaminated sediments in excavation area. Mechanical dredging and placement were used during construction activities for the Cross Bayou drainage structure to avoid excessive disturbance of soils present in the project area. The HSDRRS dredging activity was not expected to result in permanent adverse impacts on the water column (IER #1).

Three temporary canal crossings (i.e., roads) were constructed (two at the Almedia drainage structure and one at the Walker drainage structure) to facilitate access to and around the structures during construction (IER #1). All three canal crossings were constructed parallel to the drainage structures on the protected side. Culverts were installed (two for the Almedia drainage structure access roads and four for the Walker drainage structure access road) and sized appropriately to ensure that flow was not significantly altered in the channel. These temporary crossings had minor effects on water circulation for the project area relative to ongoing effects from existing drainage structures. However, because temporary access roads were degraded and removed following construction activities, no long-term effects on water current or water circulation were expected. The additional permanent access road designs for LPV-04 reach 2A and LPV-05 reach 2B included construction of bridges, which crossed the canals parallel and to the north of US 61 (IER #1); however, these construction access features were not expected to impact current pattern and water circulation for the project area.

The use of cofferdams for construction of the Cross Bayou and St. Rose drainage structures had temporary water quality impacts from increased suspended sediments, but did not permanently affect water current patterns and water circulation for the project area. Rebuilt drainage structures did not significantly alter existing water current patterns and water circulation under normal conditions.

Levees and floodwalls caused no further impacts on water circulation relative to ongoing effects from existing structures. The area between US 61 and HSDRRS structures remained predominantly isolated from the LaBranche wetlands located on the flood side of the HSDRRS structures.

Because all existing drainage structures were rebuilt and temporary access roads parallel to existing drainage structures were removed following the completion of construction activities, no significant effects on normal water fluctuations/hydroperiod occurred (IER #1).

Construction of the Walker access road likely resulted in minor alterations to existing water level fluctuations for the partially impounded wetlands to the east of the access road; however, for the portion of the access road that crosses the canal that runs parallel to and on the protected side of LPV-04, normal water level fluctuations were allowed by integrating three 48-inch culverts into the roadway design (IER #1).

The HSDRRS project detailed in IER #1 and IER Supplemental #1 did not permanently affect salinity gradients within the project area. Drainage structures were replaced or rebuilt to maintain the exchange of fresh and saline waters in the project area existing prior to the HSDRRS construction.

The nearest surface water intakes (i.e., drinking water supply) are the St. Charles Water District No. 1 intake and the St. Charles Water District No. 2 intake, which are both located on the

Mississippi River. These intakes are far removed from the project area and were not affected by construction activities.

Based on all U.S. Coast Guard (USCG) spill reports for the project vicinity for the last 5 years (USCG 2011), contaminants associated with chemical refinery air releases likely were present in the project area. However, mechanical dredging was employed to ensure that dredged material disposal activities did not adversely affect the adjacent aquatic ecosystem.

Jefferson East Sub-basin

Moderate impacts occurred on water quality. The realignment of the section of the LPV-03 floodwall (a floodwall near the Louis Armstrong New Orleans International Airport) eliminated the hard corner in the floodwall and provided a smoother transition when tied into the adjacent levee (IER #2). Removing the sharp corner from the alignment aided in reduced debris buildup and wave eccentricities, improving water quality in the long term by reducing scour and sedimentation during wave runup and storm events. Final engineering designs determined that the rock breakwater originally proposed at the I-10 Bridge was not needed, and the elimination of the breakwater from HSDRRS construction reduced the impacts on water bottoms associated with the 105 ft by 500 ft footprint of the structure originally proposed in IER #2. The filling of additional wetlands for the realignment of the LPV-03a floodwall and incorporation of a flood-side inspection road with vehicular access and turn-around points for LPV-03a adversely affected immobile benthic organisms as they were smothered by fill material. Impacts from suspended particulates and turbidity are similar to those previously described for the St. Charles sub-basin.

The realignment of the LPV-03a floodwall resulted in the localized alteration of water circulation along the flood and protected sides of the floodwall, and changes in normal water level fluctuations and hydroperiod on the protected side of the floodwall as substrate elevation was raised above the surface water elevation in wetlands on the protected side of the floodwall realignment. The wetlands impounded by the realignment were filled. In addition, the realignment prevented water circulation between the Parish Line Canal and the smaller canal bordering the Louis Armstrong New Orleans International Airport. Therefore, the modified HSDRRS action resulted in a desirable localized alteration of current patterns and water circulation, as stormwater runoff from the Airport surfaces would not directly enter Parish Line Canal (which drains into Lake Pontchartrain) from the small canal bordering the airport. Although the realignment of LPV-03a had the potential to impede saline waters from the Parish Line Canal from entering the region of wetlands to the southwest via the small canal bordering the airport, these impacts were not significant, since numerous inlets from Lake Pontchartrain to the wetlands adjacent to the project area still allowed saline water to enter the project area.

The nearest surface municipal water intakes are located along the Mississippi River and are, therefore, far removed from the project area. These intakes were not expected to be affected by construction activities.

The expanded Jefferson Lakefront Levee footprint to the flood side for wave attenuation berms and foreshore protection resulted in some loss of lake water bottom habitat, because the footprint of the new structure expanded into Lake Pontchartrain approximately 90 ft (levee reaches 1 through 3) and 50 ft (levee reach 4 west of Causeway Bridge) from the existing shoreline. Placement of additional rock for foreshore protection also impacted a 40 ft corridor of lake bottom habitat. The placement of earthen fill and/or rock along the already riprap-covered shoreline permanently covered approximately 61 acres of lake bottom (53 acres west of the Causeway bridge; 8 acres east of the Causeway Bridge). Fill required for the wave attenuation berms was brought to three previously approved land-based staging and stockpile areas by truck, and rock for the foreshore protection was brought in by barge. Additional access channels for

rock delivery and placement were created via bucket dredge. Approximately 200 acres of lake bottom were temporarily impacted by construction of the access channels and use of the stockpile sites. The access channels were backfilled with the temporarily stockpiled material, and the stockpile sites were brought to pre-construction lake bottom elevations upon project completion. Occasional redredging of the channels due to natural siltation was necessary during the course of construction. Because all material dredged for flotation access was used to backfill flotation access channels, no long-term alterations to the physical or chemical characteristics of water bottom sediments occurred (IER #3).

Placement of dredged material potentially caused increased turbidity and minor alterations to water circulation patterns in Lake Pontchartrain, which temporarily impacted water quality in the project area (IER #3). However, turbidity was minimized by the use of a bucket dredge and was further reduced due to dilution-suspended sediments through the movement of the tides and by wind-induced water turbulence. Impacts on the waters and substrate of the lake from dredging activities were temporary. The impacts of dredging, material delivery, and construction occurred primarily during the construction period of 1.5 years to 2.5 years, depending on the area of construction. Some impacts on water quality from dredging extended beyond the period of construction until the substrate stabilized. A screening-level investigation of water column impacts was conducted to determine whether the dredged material placement activities associated with the construction of temporary flotation access channels resulted in violations of water quality. For this investigation, it was assumed that an environmental clamshell bucket dredge was used for all dredging activities, and that all sediment pore water (i.e., water located in the interstitial spaces between sediments) contained by the bucket dredge was released into the water column during placement of the sediments for stockpile and access channel backfilling. Physical and chemical factors associated with the placement of dredged material were expected to cause a temporary reduction in pH. These pH variations were minor and short-lived (IER #3). No water quality violations occurred.

To evaluate the biological availability of potential contaminants in dredged material from access channels, an initial investigation for contaminant sources in the project vicinity was performed by researching USCG spill reports, the USEPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database of hazardous waste sites, the USEPA MyEnvironment websites, as well as the use of a Phase I Environmental Site Assessment (Phase I ESA) that was conducted for IER #3. The USCG spill reports and the Phase I ESA indicated the presence of many leaking transformers, which may contain polychlorinated biphenyls (PCB) in the project area (USCG 2011). It was therefore possible that PCBs from these transformers may have migrated into Lake Pontchartrain. In addition, the USGS reported chemical constituents in sediment in Lake Pontchartrain and in street mud and canal sediments in New Orleans following Hurricanes Katrina and Rita. However, it was believed that the Lake Pontchartrain sediment chemical concentrations reported immediately following Hurricanes Katrina and Rita have since diminished to levels observed prior to these hurricanes. Because stormwater from the New Orleans East Bank region of Jefferson Parish discharges into Lake Pontchartrain in the vicinity of the project area, it was anticipated that contaminants associated with urban runoff were present in lake bottom sediments in the project area.

Biological testing results for water bottom sediments in the project area generally indicate high survival (greater than 90 percent) of benthic organisms exposed to these sediments. This could either be because material was not a carrier of contaminants, or because the material meets the testing exclusion criteria. As the material was placed into the channels from which it was extracted, and because recent benthic toxicity testing for water bottom sediments in the project area indicated low mortality for benthic organisms exposed to the sediments, no significant long-term environmental effects on substrate were expected. This scenario of dredging and disposal was commonly known as a “like-on-like” condition. An estimate of the sediment pore water

concentrations released during dredged material placement activities revealed the possible exceedance of acute water quality criteria for copper; however, this exceedance was minor, and it was expected that Lake Pontchartrain waters dispersed and diluted copper concentrations in the immediate area of dredged material placement before reaching the edge of the LDEQ-regulated mixing zone, which is a radial distance of 200 ft from where the dredged material is discharged back into Lake Pontchartrain. No significant alterations of salinity gradients occurred due to the placement of dredged and fill material.

The additional rock armoring of the breakwater at the Bonnabel Pump Station #1 permanently filled 3.5 acres of lake bottom habitat (assuming a 130 ft wide base and length of 500 ft). Construction of the bridge to be used for operation and maintenance for the Duncan Pump Station breakwater did not result in additional impacts, as the new bridge had a footprint similar to the bridge evaluated in IER #3. The placement of additional rock armoring and breakwater at Pump Station #1 disturbed water bottom sediments and resulted in the resuspension of water bottom sediments and associated pore water. It was presumed that Lake Pontchartrain waters sufficiently mixed and thereby diluted the sediment pore water associated with resuspended water bottom sediments for copper levels to fall below the acute water quality criteria by the time pore water reached the edge of the LDEQ-regulated mixing zone. The mixing zone is defined as a radial distance of 200 ft from where additional rock armoring and breakwater construction activities occurred. No significant alterations to current patterns or water circulation resulted from the placement of additional rock armoring (IER #3).

Dredging for barge access and flotation and temporary stockpiling of material adjacent to the access channel was required for detour lane construction at the LPV-17 Bridge Abutment and Floodwall Tie-ins at Causeway Bridge. Temporary impacts east of the Causeway Bridge totaled approximately 5.2 acres (2.7 acres access/flotation channel impacts; 2.5 acres stockpile impacts). Temporary impacts west of the Causeway Bridge totaled 5.3 acres (2.7 acres access channel impacts; 2.6 acres stockpile impacts). The stockpile site east of the Causeway Bridge was encircled by a silt curtain on all sides except the side closest to the access channel in an effort to contain the dredged material and minimize impacts on water quality from turbidity, to the maximum extent practicable.

Orleans East Bank Sub-basin

The placement of uncontaminated fill material in open water and wetlands caused temporary increases in suspended particulates and turbidity as previously described for the work conducted in the St. Charles sub-basin. Minor permanent impacts on water quality occurred from increased impermeable surfaces and increased fill, but no significant alteration in water currents or circulation and no significant change in hydroperiod or salinity gradients occurred as a result of the HSDRRS (IERS #4, #5, and #27).

New Orleans East Sub-basin

Moderate permanent adverse impacts occurred on water quality. Placement of fill material in conjunction with the levee and floodwall construction, as described by IERS #6 and #7, principally impacted wetlands substrate, as the fill material used to extend the levee footprint encroached on wetlands. Impacts on water quality from the placement of fill were similar to those described for the St. Charles sub-basin HSDRRS construction (as described by IER #1). Earthen levee sections were revegetated to reduce long-term erosion and scour on the flood and protected sides of critical portions of the levees and floodwalls, which further reduced the turbidity impacts associated with the project.

Water circulation and current patterns were not significantly impacted. However, wetlands and open water areas that were converted to uplands due to the placement of fill material eliminated current pattern and water circulation for those specific locations, but did not have a significant effect on the overall waterbody within the project area due to the scale and location of the impacts.

Because the water level fluctuations in the wetlands enclosed by levees (i.e., Bayou Sauvage NWR) were and will continue to be regulated by water control structures, no significant effects on normal water fluctuations/hydroperiod occurred (IERs #6 and #7). Further, no significant alteration of salinity gradients resulted from the placement of fill material for levee construction in association with either HSDRRS project.

Approximately 41 acres were impacted for permanent and temporary easements for the Seabrook gate complex; however, there were no impacts on wetlands or wetlands substrate as a result of the construction (IER #11 Tier 2 Pontchartrain). Impacts from suspended sediments and increased turbidity from construction are similar to those described for the St. Charles sub-basin. However, additional permanent beneficial impacts on DO and turbidity occurred from the filling of the scour hole at the IHNC, which could improve water quality conditions in the project area and in nearby areas of Lake Pontchartrain. Scour patterns around temporary structures, such as the cofferdam used for the IHNC barrier and sector gate construction (IER #11 Tier 2 Pontchartrain), had the potential to erode bottom material and suspend that material in the water column. The scouring nature of flows through the portion of the IHNC at the project location suggested that there were not likely to be substantial deposits of organic and inorganic sediments or concentrations of chemically reduced substances that could be moved into the water column by construction activities or resultant changes in scouring flows. Changes in patterns of turbulence and scour caused by construction activities potentially forced hypoxic, relatively saline water from the scour holes into the overlying water column. The temporal and geographic extent of the possible impact from disturbance of the scour holes depended on the degree of hypoxia and the amount of disturbance. If DO concentrations in the scour holes were near 0 milligrams per liter (mg/L), then hydrogen sulfide, which is toxic to aquatic organisms, could enter the water column along with water with low DO. Rapid increases in salinity, accompanied by exposure to low oxygen levels and hydrogen sulfide, may have occurred temporarily in the vicinity of the project. Dilution of water from the scour holes with overlying water was expected to limit effects of these conditions on the area around the construction site (IER #11 Tier 2 Pontchartrain).

Modeling of flows with the new sector gate showed that flows should be similar to preconstruction conditions, and less than historic flows before the closure of the MRGO at Bayou LaLoutre as part of the MRGO Deep-draft Deauthorization Project (IER #11 Tier 2 Pontchartrain). There were moderate temporary impacts on salinity during construction, and negligible permanent impacts (0.1 ppt to 0.3 ppt decrease) above those caused by the closure of the MRGO and Borgne barrier occurred. During construction, a cofferdam spanned the IHNC. This altered circulation patterns, salinities, and DO levels on the north and south sides of the cofferdam. The IHNC is ebb-dominated and salinities directly north of the cofferdam had the potential to become slightly lower than the current levels, and conversely salinities south of the cofferdam increased slightly. Modeling suggested that when flow through the IHNC was closed (such as when the cofferdam was in place during construction or when the structures will be closed), higher DO values on the order of 4.0 mg/L to 4.2 mg/L likely occurred south of the structure. North of the structure, closure of the channel resulted in reduced DO values that ranged from 5.3 mg/L to 4.1 mg/L (USACE 2009y). The north scour hole was not modified under the HSDRRS action. This scour hole continues to accumulate higher salinity water which would also become hypoxic. These high salinity/low oxygen conditions continue to create a hypoxic zone along the bottom of a portion of Lake Pontchartrain near the IHNC.

The impacts on substrate from the Borgne barrier construction (IER #11 Tier 2 Borgne) included open water (approximately 64 acres) and wetlands substrate. The majority of the impacts on open water substrate were on deep channel bottoms of the MRGO (approximately 22 acres) and the GIWW (approximately 31 acres). Most of the wetlands substrate impacts were on brackish marsh, primarily the area associated with the concrete barrier across the marsh. The impacts on suspended sediments and turbidity from the Borgne barrier construction were temporary and similar to those described for the St. Charles sub-basin activities. The dredge material disposal area increased the potential for suspended sediments to be temporarily released into the water column (IER #11 Tier 2 Borgne). The Borgne barrier changed water flow patterns in the vicinity of the project by completely preventing water in the MRGO from entering the GIWW. The discharge of dredged material for marsh restoration in the wetlands of the Golden Triangle had negligible impacts on flow patterns by converting approximately 14 acres of open water areas to marsh, and reducing the depth of the remaining open water areas. However, no significant changes in the hydroperiod on either side of the structure are anticipated under normal circumstances (i.e., floodgates open). Any changes in hydroperiod associated with the Borgne barrier would be temporary and would only occur during the passage of a large storm or hurricane, when the floodgates are closed (IER #11 Tier 2 Borgne).

The CEMVN has committed to conducting monitoring to obtain observed rather than predicted DO data to determine the long-term cumulative impacts of the Borgne barrier and Seabrook gate complex (IER #11 Tier 2 Pontchartrain and IER #11 Tier 2 Borgne). The data are currently being collected and the data collected to date are presented in appendix G. It is anticipated that the data collection will continue into 2013, and a report will be prepared detailing the final results of the DO and salinity data collection efforts. Those data and interpretation of changes in DO and salinity will be utilized by CEMVN to evaluate alternatives for providing rectification or mitigation to offset adverse impacts if the cumulative impacts from the structures on water quality are determined to be detrimental to the Lake Pontchartrain estuary.

Chalmette Loop Sub-basin

Moderate permanent impacts occurred on water quality from the construction of T-walls and floodgates. Approximately 0.3 acre of estuarine substrate in Bayou Dupre was filled by placement of the flood control structure (IER #8). Impacts on turbidity from suspended sediments during construction are similar to those previously described for the St. Charles sub-basin construction. The construction of the flood control structure did not substantially alter water circulation or flow patterns, and no significant alteration of normal water fluctuations occurred (IER #8). Salinity gradients were not changed as a result of the flood control structures.

The Caernarvon floodwall construction impacted wetlands and open water substrate, as fill material associated with project features was placed over these substrate types. Construction of the water control structure across the Caernarvon Canal temporarily disrupted approximately 0.5 to 1.5 acres of water habitat (IER #9). Approximately 0.3 acre of the canal bottom was permanently occupied by the water control structure. Impacts on water quality from increased turbidity and suspended sediments were similar to those described for the St. Charles sub-basin. Construction of the Caernarvon floodwall led to temporary impacts on the water column, including elevated nutrient levels, chemical oxygen demand, and BOD, which can in turn lead to reduced DO levels. However, these effects were temporary and occurred only during construction.

Current patterns and water circulation for the region surrounding the Caernarvon floodwalls were not significantly altered (IER #9). Because the section of floodwall that parallels the canals was built upon high ground, it generally did not impede surface water movement through this region of wetlands. The section of floodwall connected to the western end of the flood control structure divided a substantial pool of standing water. However, as the abundance of floating aquatic

vegetation indicated, existing surface water movement within this pool was very limited. Therefore, the impacts on current patterns and water circulation resulting from the subdivision of the pool should be negligible. The floodwall sections, which run perpendicular to the canals, diverted the limited surface flows present in the project vicinity and enclosed approximately 2 acres of wetlands. However, these wetlands were isolated before construction; therefore, drainage of these wetlands was not expected to differ significantly as a result of the HSDRRS action. Therefore, the impacts associated with the alteration of water circulation and current patterns resulting from this section of floodwall were not significant (IER #9). Installation of a cofferdam during construction of the flood control structure potentially resulted in a temporary reduction of surface water flows normally occurring through the Caernarvon Canal. Once the construction was completed, surface flows through the canal were expected to return to near pre-construction conditions.

The Caernarvon floodway was not expected to alter normal water level fluctuations or hydroperiod. As the flood gate will remain open except during major storm events, water level fluctuations within the protected side of the canal did not change as a result of the project. The floodwall between the Caernarvon Freshwater Diversion Channel and the Caernarvon Canal could cause minor modifications of the normal water level fluctuations and hydroperiod for the region of wetlands enclosed by the floodwall. However, these impacts are not significant, as this region of wetlands appears to already be confined hydraulically by the existing, elevated Caernarvon Canal and Caernarvon Freshwater Diversion Channel banklines. There was no effect on salinity gradients within the project area (IER #9).

The placement of borrow material associated with the Chalmette Loop levee and floodwall construction permanently eliminated 420 acres of wetlands and 11 acres of open water habitats (IER #10). Impacts from suspended sediments and turbidity during construction activities were similar to those previously described for the St. Charles sub-basin. No significant alterations of water currents and circulation were expected and the levee and floodwall construction did not affect salinity gradients within the project area (IER #10).

Belle Chasse Sub-basin

Construction of the Harvey and Algiers Levees and Floodwalls, and Hero Canal Levee and Eastern Tie-in (IER #13) directly impacted wetlands and hydrologically altered (i.e., non-wet) non-jurisdictional BLH habitat having minor permanent impacts on water quality. The temporary impacts on water quality from suspended sediments and turbidity during construction were similar to those described for the St. Charles sub-basin construction. The action included mechanical placement of dredged sediments, and an estimation of contaminant concentrations from dredged material discharge waters was performed for this placement method (IER #13). The screening evaluation indicated that no dilution was required for effluent to meet water quality criteria for mechanically placed material. The current patterns, water circulation, and salinity gradients were not significantly impacted. Wetlands and open water areas that were converted to upland due to the placement of fill material eliminated current pattern and water circulation for those regions. However, this did not significantly affect the overall waterbody within the project area due to the scale and location of the impacts.

Gretna Algiers Sub-basin

Placement of fill material in conjunction with the construction of levees and floodwalls impacted wetlands (IER #12 and IER Supplemental #12) and had a moderate permanent impact on water quality. On the eastern section of the alignment, approximately 9.6 acres of these wetlands impacts occurred within the Bayou aux Carpes CWA Section 404(c) area. Temporary construction impacts on water quality from increased suspended sediments and turbidity were similar to those described for the St. Charles sub-basin. Because the levee and floodwall

construction required the hydraulic or mechanical placement of dredged sediments, estimation of effluent contaminant concentrations was performed for both methods of placement. The screening evaluation indicated that no dilution was required for effluent to meet water quality criteria for hydraulically or mechanically placed material. Wetlands and open water areas that were converted to upland due to the placement of fill material eliminated water current patterns and circulation for those regions. However, this did not significantly affect the overall waterbody within the project area due to the scale and location of the impacts. Placement of dredged material along the eastern shoreline of Lake Salvador for marsh creation did not result in significant alteration of current patterns and water circulation of Lake Salvador and nearby canals and bayous. The elevated substrate and marsh vegetation effectively reduced the rate of water flow through the marsh creation area, subsequently reducing the effects of current patterns and water circulation (IER #12 and IER Supplemental #12); but this reduction in flow and increased retention time in wetland vegetation provides a long-term water quality benefit. No long-term changes in water level fluctuations, hydroperiod, or salinity gradients occurred as a result of the construction.

Harvey Westwego Sub-basin

For the construction activities, wetlands and 1.7 acres of water bottom were filled for floodwall and retaining structure construction, bottom paving, bankline stabilization, and horizontal directional drilling activities (IER #14 and IER Supplemental #14) which had a minor permanent impact on water quality. The placement and backfill of wetlands sediments in association with pipeline relocation activities did not occur in the vicinity of any major water bodies; therefore, these activities were not expected to result in significant water column impacts (IER #14 and IER Supplemental #14).

The expansion of the WBV-14c footprint resulted in localized alteration of current patterns and water circulation along the flood side of the levee, as substrate elevations for the expanded footprint no longer provided for surface water. However, this activity did not result in significant alteration of current patterns and water circulation of the overall wetlands area in the project vicinity. The filling of open water and bankline habitat associated with the flood-side shift of the floodwall connecting the Ames and Mount St. Kennedy pump stations, in combination with the temporary filling of open water and bankline habitat for the construction of cofferdams surrounding the pump stations, were not expected to result in the alteration of current patterns, water circulation, water fluctuations or hydroperiod, as pump station discharges were routed into the Millaudon Canal during construction activities. Following construction activities at the pump stations, temporary cofferdams were removed, and the floodside shift of the connecting floodwall caused minor impacts on water circulation in Millaudon Canal. Pump station discharges before, during, and after construction were always into Millaudon Canal. No long-term modifications of current patterns and water circulation were expected (IER #14 and IER Supplemental #14).

The expansion of the WBV-14c footprint resulted in the localized alteration of normal water level fluctuations and hydroperiod, as the levee footprint was raised above the surface water elevation present in surrounding wetlands. However, these effects were localized, as no alteration to water fluctuations or hydroperiod occurred for the overall area of wetlands and open water adjacent to WBV-14c. No long-term modifications of normal water fluctuations, hydroperiod, or salinity gradients occurred.

Lake Cataouatche Sub-basin

Moderate permanent impacts occurred on open water from the Lake Cataouatche Levee construction (IER #15) through some filling of the Outer Cataouatche Canal. Impacts on water quality from increased turbidity and suspended sediments were only temporary during levee

construction activities. No significant alteration of water current patterns, circulation, or salinity gradients occurred.

Placement of fill material in conjunction with Western Tie-in construction activities (IER #16 and IER Supplemental #16) impacted hundreds of acres of wetlands and open water habitat through filling activities. Construction of the traffic detour and emergency bypass road and ramps on River Road (LA 18) required 1,300 cy of fill material and 180 tons of asphalt. Approximately 155,000 cy of material was displaced: 95,000 cy from the channel passing under US 90, 50,000 cy from the Bayou Verret navigation structure, and 10,000 cy from the bypass channel. Soil excavated from the drainage canal passing under US 90 was used as levee fill material if it met the necessary requirements. Other excavated material was used for staging areas. Some of the fill material was excavated on-site in the western section of the project area, while the remaining material was obtained from off-site borrow areas. Placement of fill material for this use into the aquatic environment did not result in adverse long-term water column impacts. Flow within the region around where installation of earthen enclosures occurred was very slow, and turbidity effects were localized and temporary. A sand cell barrier was constructed to hydrologically isolate levee construction, which indirectly provided some water quality benefits.

Fill material was placed in wetlands for the construction of staging areas. Fill material used for staging areas could have been material excavated or mechanically dredged from other sections of the project area, as well as from borrow sites. Where mechanical dredging occurred, it displaced surface water and released little or no effluent during dredged material placement (IER #16 and IER Supplemental #16).

Water current patterns and circulation within the wetlands were altered. Drainage routes from US 90 and the north changed little between pre- and post-construction. The main change in drainage in this region was the enlargement of a drainage canal on the western half of the Outer Cataouatche Canal. Water exchange was maintained between wetlands north and south of US 90 with the enlargement of the drainage canal.

The earthen closure structure to the west of Outer Cataouatche Canal cut off a small portion of the canal from Sellers Canal (IER #16 and IER Supplemental #16). To remedy any potential water circulation issues in the area between the Western Tie-In levee and the Davis Pond east guide levee, a gap was made in the Davis Pond east guide levee to retain water exchange with wetlands. The purpose of this guide levee for Davis Pond is not surge protection, but to stop any Mississippi River water from backflowing into residential areas. The Western Tie-in Levee functionally replaces the east guide levee. Placing a gap in the guide levee hydrologically reconnected the disconnected canal section to the wetlands area and minimized water stagnation in the section. However, the gap was closed due to flooding along US 90 from heavy rainfall not draining properly due to flooding of ground-level crossings under US 90. Instead of the gap, a structure will be installed in the area where the levee alignment crosses the Outer Cataouatche Canal. The structure will allow water exchange to the area bounded by US 90 (to the north), Davis Pond east guide levee (to the west and south), and the new Western Tie-in levee (east). The structure will be built within the levee and remain open most of the time. Instead of allowing water exchange directly to Davis Pond, water exchange will occur through Bayou Verret through the new Bayou Verret Structure.

Wetlands south of US 90 and the Outer Cataouatche Canal saw the most significant alteration with the implementation of two earthen enclosures and a navigable structure expected to be closed during storm surges. The Outer Cataouatche Canal is a significant point for water collection to the area north of US 90. The canal drains into wetlands to the south and into Lake Cataouatche using two canals: a canal running parallel to the Area 90 Landfill along the St. Charles Parish and Jefferson Parish line, and Sellers Canal. The closure of the canal running

along the Area 90 Landfill made Sellers Canal (Bayou Verret) the primary channel for drainage from the Outer Cataouatche Canal to Lake Cataouatche. In storm events where storm surge could lead to flooding in regions north of the Outer Cataouatche Canal, the Bayou Verret closure structure will be closed. Significant rain events may increase the water level of wetlands north of US 90. Water levels in the protected wetlands would be expected to return to normal within several days after passage of an event where the gate would be closed (IER #16 and IER Supplemental #16).

An unnamed canal immediately south of Outer Cataouatche Canal and west of Sellers Canal was permanently filled. It appears that this canal drained nothing, as it had no apparent source or sink of water, but was a channel cut through an interspersed open-water and vegetated wetlands. Water circulation effects appeared negligible in this area.

The project, including placement of excavated and fill material, was not expected to affect salinity gradients. Water within the project area is known to be freshwater after construction of the nearby Davis Pond water diversion structure. Water quality analysis of the Outer Cataouatche Canal shows saline concentrations being 0.5 part per thousand (ppt) or less. Criteria differentiating brackish and freshwater (0.5 ppt) designate water within the project area as freshwater.

Hydrography of the area was reviewed with respect to known or anticipated sources of contaminants. Current information about the landfills in the area show that contamination associated with them, if any, was unlikely to reach the area where material was excavated. Previous testing was reviewed with the finding that no chemicals detected within the soil or water violated any USEPA or LDEQ concentration parameters.

The aquatic area affected by the Company Canal floodwall construction included fill of wetlands and open water from the realignment of Bayou Segnette and the construction of a sector gate structure across Bayou Segnette. Final grading plans required the placement of fill a short distance into the open water of the existing canal and the filling of additional areas of open water. Impacts on water quality from suspended sediments and turbidity as a result of floodwall construction activities were similar to those described for the St. Charles sub-basin. No significant alteration of water current patterns, circulation, or salinity gradients occurred.

Areas Outside of the HSDRRS Project Area

Temporary minor impacts occurred on DO levels and water quality due to nutrient loading, SOD, miscellaneous debris, and accidental spills from borrow site excavation activities. Dewatering activities during borrow site excavation temporarily increased suspended sediment concentration in waterways and wetlands near discharge points. No permanent impacts on water quality from borrow site construction and use occurred. Borrow sites were constructed in upland environments, and the bed and banks of open water bodies created from borrow site construction would quickly stabilize and would not contribute to sedimentation and turbidity of nearby waterways during storm events. The water bodies would remain isolated and would not contribute to any degradation of existing water bodies in the region.

4.2.2.2.2 HSDRRS 2057 Impacts

Direct minor, short-term, construction-related impacts on water quality from the future levee lifts would include decreased DO levels in the waters immediately surrounding the construction site, excessive turbidity due to construction runoff and sedimentation, and increased water body temperature due to the increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts would occur due to increased nutrient loading, SOD, miscellaneous debris, and accidental spills from construction

equipment. Indirect impacts include alterations to hydrology, which could result in water column impacts, alteration of patterns, water circulation, and normal water fluctuations, in addition to changes to salinity and nutrient loads in the water. After construction, the conditions would be expected to stabilize, allowing for suspended sediments to settle and vegetation to re-colonize the area. Construction-related impacts would also affect lake bottoms, canal bottoms, drainage waterways, and open water. Direct impacts from dredging include increased turbidity during dredging, disruption of water bottoms from access channels and material stockpiles, and destruction of submerged aquatic vegetation (SAV). Impacts on water quality from future levee lifts would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) which would be described in each future project's SWPPP.

The improvement of existing foreshore protection described in IERs #6 and #7 was not needed for the 100-year level of risk reduction for 2011, but may be implemented by 2057 within the New Orleans East sub-basin. This foreshore protection would impact approximately 4 acres of wetlands, and require access dredging in Lake Pontchartrain, which would have direct short-term impacts on water quality from increased turbidity.

4.2.2.3 Cumulative Impacts

4.2.2.3.1 Cumulative Impacts for HSDRRS 2011 and HSDRRS 2057

Short-term, direct moderate cumulative water quality impacts would result from filling waterways and wetlands (open water aquatic, fresh marsh, brackish, and swamp habitats) for all HSDRRS projects, future levee lifts, and maintenance activities. However, following the completion of fill activities and stabilization of material, there would be no further impacts on water quality.

The direct cumulative HSDRRS (2011 and 2057) impacts on water quality would be associated with the actual construction activities; the associated dredge, fill, and material stockpiling activities; water body displacement; increased impervious surfaces; and hydrologic modifications of waterways and ecosystems. This would likely cause sedimentation and nutrient loading of waterways from stormwater runoff during rain events. These moderate permanent impacts would include changes in water temperature, salinity, turbidity, DO, hydrology, and water velocity. These water quality impacts could in turn affect other water-related resources, such as wetlands, fisheries, and EFH.

4.2.2.3.2 Impacts of other Present and Future Regional Actions

Collectively, other present and future levee construction projects, storm damage reconstruction, redevelopment, and transportation projects would have cumulative short-term moderate adverse impacts on water quality in the region due to stormwater runoff from construction sites, dredging, and hydro-modification. Cumulative long-term moderate adverse impacts on water quality would occur due to an increase in impermeable surfaces. Impacts of other ongoing and future regional actions are similar in many of the sub-basins and parishes affected by the HSDRRS.

Storm Damage Reconstruction

Where storm damage reconstruction projects are constructed within the current structural project footprint on previously disturbed upland areas, they would disturb very little soil and would have minor direct impacts on water quality. There is the potential for spills of materials and waste during construction activities that could adversely impact water quality; however, most spills during reconstruction activities would be confined to upland environments restricted by a forced drainage system. Water quality would return to pre-construction conditions when reconstruction activities have been completed. However, reconstruction projects that occur in water bodies,

such as rebuilding of bridges and reconstruction of marinas and harbors, have the potential to directly impact water quality from stormwater runoff and from spills during construction activities. These projects would result in cumulative adverse impacts on water quality. Sewage and drainage treatment infrastructure enhancement would improve water quality by capturing, controlling, and filtering tertiary runoff.

Redevelopment

Most present and future redevelopment projects would occur in urban areas where the land has already been highly modified and disturbed. These projects are not likely to impact water quality due to the urban setting. Short-term cumulative impacts on water quality would be similar to the storm damage reconstruction projects during construction for projects in urban areas; however, water quality in general would return to pre-construction conditions after redevelopment activities cease, and implementation of mitigation measures and/or BMPs would minimize long-term cumulative impacts.

Redevelopment projects that expand into rural or more natural and undisturbed environments could result in direct water quality impacts, as open water and wetlands are filled and converted into industrial, residential, or commercial land use and during construction runoff. Clearing BLH, dredging pipeline canals, rebuilding camps and boat houses, replacing pilings, repairing sewer lines, and constructing bridges and roads would have long-term cumulative impacts on water quality through increased impermeable surfaces and a higher probability of spills of contaminants.

Coastal and Wetlands Restoration

Although some restoration projects may have short-term adverse impacts on water quality from dredging and filling, restoration projects improve water quality in the long term by collecting and filtering sediment and nutrients and by reducing soil erosion. The Bonnet Carré Freshwater Diversion project (St. Charles sub-basin), the MRGO Deep-draft De-authorization and associated Ecosystem Restoration project (Chalmette Loop, Jefferson East Bank, and Orleans East Bank sub-basins), the Bayou Sauvage NWR Hydrologic Restoration project Phase 1 and Phase 2 (New Orleans East sub-basin), the Violet Canal Freshwater Diversion, and the Caernarvon Diversion Outfall Management project (Chalmette Loop sub-basin) are all expected to significantly reduce the continued loss of wetlands within coastal Louisiana, and improve salinity gradients, hydrology, and water quality throughout the HSDRRS project area. Construction of artificial reefs, shoreline protection projects, and installation of oyster reefs all cumulatively contribute to short-term impacts on water quality during their construction; however, most of these projects provide long-term water quality benefits.

On January 30, 2009, the MRGO closure at the Bayou La Loutre ridge altered water flows and salinities in the MRGO between the Gulf of Mexico and the GIWW, Lake Borgne, and the IHNC. This action is expected to reduce the salinity of adjacent water bodies, thereby beneficially impacting water quality. Since the MRGO rock closure was put in place, there have been anecdotal reports that shifts in the location of productive fishing spots south of the closure have occurred and old access routes to these spots have changed, but fishing in and around Highway 11, and the Twin Spans, the Rigolets, Lake Borgne, and Bayou Bienvenue has improved. Tidal flow through the canals has been greatly reduced, so stratification and low DO conditions are expected to exist during such times.

Flood Risk Reduction Projects

Other flood risk reduction projects would contribute to adverse impacts on water quality through the filling of wetlands from levee and floodwall expansion. Construction-related surface water runoff would increase turbidity and sedimentation in streams, canals, drainage ways, and lakes in the vicinity of the projects, but most impacts would be temporary during construction, and would be minimized with the use of BMPs. Long-term permanent cumulative water quality impacts

occur from increased stormwater pumping capacities, improved drainage through urban canals, and a reduction in overall areas that remain intertidal. Projects such as Morganza to the Gulf and New Orleans to Venice place more areas behind risk reduction structures. Further, these projects include those areas within forced drainage systems that have point discharges of sediments and nutrients during and immediately following storm events.

Transportation

Repairs to highway and road infrastructure and new road and highway alignments would have little to no cumulative effects on water quality due to the fact that most of the projects are being constructed in previously disturbed areas and are short-term construction activities. Even for those projects that could be constructed along undeveloped corridors, such as the Bush to I-12 project (USACE 2012b), impacts on water quality would be short-term and localized, and reduced through the implementation of BMPs. Most of the impacts would be from construction-related and typical roadway pollutant runoff. Implementation of mitigation measures and BMPs would minimize long-term cumulative impacts.

Other Regional Actions

The BP Deepwater Horizon spill impacted water quality within much of the northern Gulf of Mexico through the release of crude oil, and tar balls have been found as far north as Lake Pontchartrain. The impacts on water quality from this oil spill are still being assessed, but the spill had significant short-term adverse impacts on water quality in the region, and it is anticipated that the residual impacts from the spill would contribute to the cumulative degradation of water quality in the region.

Overall, cumulative moderate long-term impacts on water quality would occur in the HSDRRS region, but the incremental effects of the HSDRRS would not be significant. Water quality would continue to be influenced by industrial and commercial uses that are prevalent along the Mississippi River throughout the project area, and these uses have the greatest impact on water quality regionally. Past and future construction activities would cumulatively modify the surface hydrology, increase turbidity, decrease DO, increase suspended sediments, and may slightly increase temperature.

4.2.2.3.3 Summary of All Cumulative Impacts for Water Quality

In general, there would be cumulative moderate impacts on water quality from HSDRRS due to an increase in impermeable surfaces and hydro-modification. Concurrent construction of the HSDRRS caused short-term cumulative impacts on water quality that potentially temporarily exceeded the LDEQ water quality standards. The hydrology in the project area was slightly modified as compared to the historic hydrologic regime. Cumulative adverse indirect impacts for several resources occurred due to the closure of MRGO.

Collectively, other present and future levee construction projects, storm damage reconstruction, redevelopment, and transportation projects would have cumulative short-term moderate adverse impacts on water quality in the region due to stormwater runoff from construction sites, dredging, and hydro-modification; however, they are not expected to have significant cumulative long-term impacts on water quality within the HSDRRS project area.

Water quality in the region is impaired because of existing commercial and industrial uses, and point source discharges of stormwater and wastewater. The HSDRRS construction and maintenance, in combination with all other regional construction projects regardless of size and scope, would have adverse moderate cumulative impacts on water quality that would contribute to water quality impairment.

4.2.3 Wetlands

Wetlands are areas where water saturation is the dominant factor determining the characteristics of soil development and types of plant and animal communities living in the area. Water is present either at or near the surface of the soil or within the root zone all year or at various durations throughout the year, including the growing season. The prolonged presence of water results in the selection of plants that are adapted to survive under saturated conditions and can grow in the soils that form under flooded and saturated conditions (hydric soils). Marshes, swamps, bogs, and wet BLH habitats are wetland habitats.

4.2.3.1 *Affected Environment*

Louisiana has been losing land at an average rate of 34 square miles per year for the last 50 years (USGS 2003). From 1932 to 2000, approximately 1,900 square miles of land was lost in coastal Louisiana (figure 4-4). In addition, Louisiana accounted for approximately 90 percent of the coastal marsh loss in the lower 48 states in the 1990s (Couvillion et al. 2011, USGS 2003, Dahl et al. 1991). The high rate of wetlands loss in coastal Louisiana is directly related to the high rates of subsidence, as well as development of human infrastructure (USACE 2007a, Boesch et al. 1994). Some of the wetlands loss is due to canalization or filling of wetlands for development. Hurricanes Rita and Katrina directly converted 198 square miles of marsh into open water in Louisiana during the 2005 hurricane season (Barras et al. 2008).

Historically, a balance was maintained between wetlands formation and loss in the Louisiana deltaic plain from overbank sediment deposition in actively forming delta lobes and subsidence and deterioration processes in abandoned delta lobes. The coastal wetlands balance has been interrupted by changes to the Mississippi River. The river's suspended sediment load has been reduced by 80 percent since 1850 (Kesel 1987) due to dams on major tributaries, land use changes in the watershed, overbank storage and channel bed aggradation, and alterations to the landscape such as flood risk reduction projects and navigation channels (Allison et al. 2012, USACE 2004a). Overbank flooding of the Mississippi River and its tributaries has been greatly restricted, and in many cases eliminated, removing the source of sediment and freshwater that built and maintained coastal marshes relative to subsidence and sea-level rise (Roberts et al. 1980). The maintenance of the Mississippi River in its current course and subsequent changes to the delta cycle now cause the majority of sediment deposition and fresh water to be discharged off the continental shelf. Another problem is the intrusion of saltwater into historically less saline marshes.

Cypress-tupelo swamps and BLH forests once were more common in the HSDRRS project area than they are today. The loss of these habitats due to wind, storm surge damage, and saltwater intrusion into previously freshwater or brackish marshes has greatly impacted the regional habitat and biological resources in the project area (USACE 2007a). Most of the cypress-tupelo swamps were removed from Louisiana between 1876 and 1956, a period of intense logging (Keddy et al. 2007). Other areas such as the Central Wetlands Area experienced a dramatic change in vegetation in the early 1960s as a result of the construction of the MRT and MRGO and associated saltwater intrusion. In the last 100 years, a large portion of historical BLH habitat has been logged and converted into agricultural and urban lands (Dahl et al. 1991). Approximately 200 years ago, 30 million acres of BLH covered the southeastern U.S., but it is estimated that loss rates were as high as 431,000 acres per year from 1965 to 1975. As a result, very little original BLH habitat exists in the southeastern U.S. (USEPA 2009a). Any remaining BLH forest within the project area has been dramatically impacted by alteration of natural hydrology due to extensive water control measures and development. This has led to the gradual conversion of BLH into upland habitat due to the colonization of upland species (Coastal Wetlands Forest Conservation and Use Science Working Group 2005). Although numerous wetlands restoration projects have been implemented in coastal Louisiana, to date, these projects have had little effect on the overall rate of wetlands loss in the system.

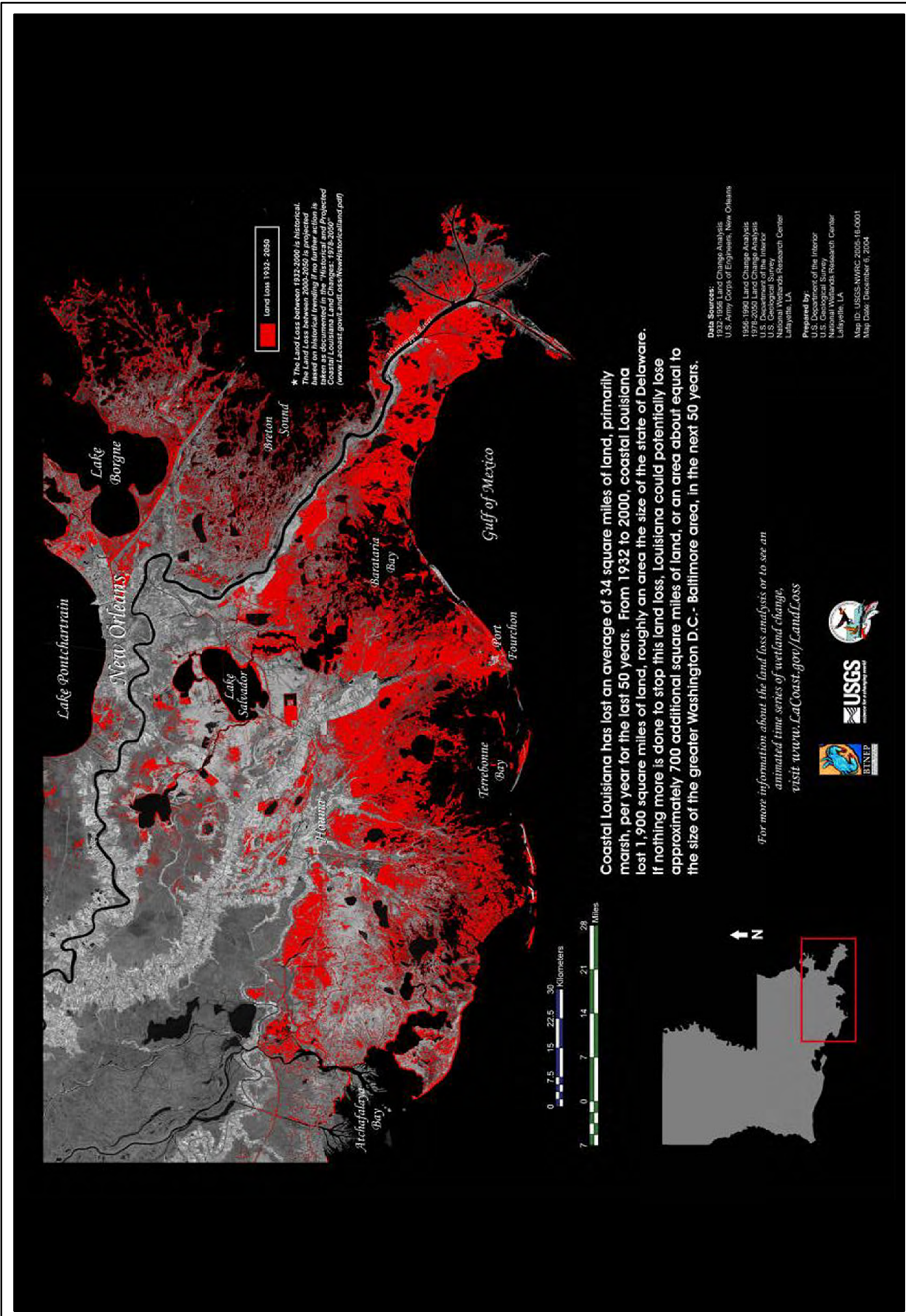


Figure 4-4: Historical and Projected Land Loss for Southeast Coastal Louisiana

4.2.3.1.1 Existing Conditions

The HSDRRS is located primarily at the confluence between the urban, developed portions of the Greater Metropolitan New Orleans Area and the surrounding coastal wetlands and estuaries. Large wetlands areas located within the HSDRRS include the Bayou Sauvage NWR in New Orleans East, the Central Wetlands Area in the Lower Ninth Ward of Orleans Parish and St. Bernard Parish, the LaBranche Wetlands in St. Charles Parish, and wetlands in the Bayou aux Carpes Clean Water Act 404(c) area and in JLNHPP. Numerous BLH forest areas are also located within the HSDRRS project area on the west bank north of Lake Cataouatche and in the Harvey/Belle Chasse areas.

The Bayou aux Carpes Clean Water Act 404(c) area's origins begin with the Harvey Canal-Bayou Barataria Levee Project, authorized in the 1960s, located south of the V-line levee southwest of Belle Chasse. This project included draining over 3,000 acres of the Bayou aux Carpes wetlands for developmental purposes. In October 1985, the EPA exercised its veto authority under Section 404c of the Clean Water Act, and with three specific exceptions, prohibited discharges of dredged or fill material to wetlands in the Bayou aux Carpes site. This area is bounded by the existing V-line levee, the Old Estelle Outfall Canal, Bayou Barataria, Bayou des Familles, and the Lafitte-Larose Hwy. The Federal District Court for the Eastern District of Louisiana subsequently found that the EPA action, which rendered the original project infeasible, was consistent with the law and was supported by the agency's administrative record. The prohibitions on discharges of dredged or fill material in the Bayou aux Carpes site remains in effect.

Wetlands within the project area provide plant detritus to adjacent coastal waters and thereby contribute to the production of commercially and recreationally important fishes and shellfishes. Wetlands provide valuable water quality functions such as reducing excessive dissolved nutrient levels, filtering waterborne contaminants, and removing suspending sediment matter. In addition, coastal wetlands buffer storm surges and reduce damaging effects on man-made infrastructure within the coastal area (USFWS 2008). Wetland habitats are categorized in the following discussion and can be seen in figure 4-5.

Marsh

Marshes are land masses that are frequently or continually inundated by water and are characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions (USEPA 2009b). Marsh types within the HSDRRS project area include fresh, intermediate, brackish, and saline marsh. Fresh and intermediate marshes are generally found upstream from brackish waterways, where there is minimal tidal action and a reduced level of saltwater in the systems. Common vegetation includes arrowhead (*Sagittaria* spp.), pickerelweed (*Pontedaria* spp.), pennywort (*Hydrocotyle* spp.), maidencane (*Panicum hemitomon*), and cattail (*Typha* spp.). Intermediate marshes generally have low salinities throughout the year, but salinity peaks during the late summer and early fall. Vegetation may include saltmeadow cordgrass (*Spartina patens*), bulltongue (*Sagittaria lancifolia*), and wild millet (*Echinochloa* spp.). The fresh marsh within the project area is concentrated along the Mississippi River in Plaquemines Parish and in the region surrounding Lake Cataouatche. Intermediate marsh is prevalent in the interior Chalmette Loop sub-basin, as well as the southern Belle Chasse, Gretna-Algiers, and Harvey-Westwego sub-basins (Sasser et al. 2008). Some areas of freshwater and intermediate marshes in the project area are flotant marsh. Flotants are floating marshes that are entirely floating or poorly anchored to the underlying substrate and are composed of very little mineral matter.

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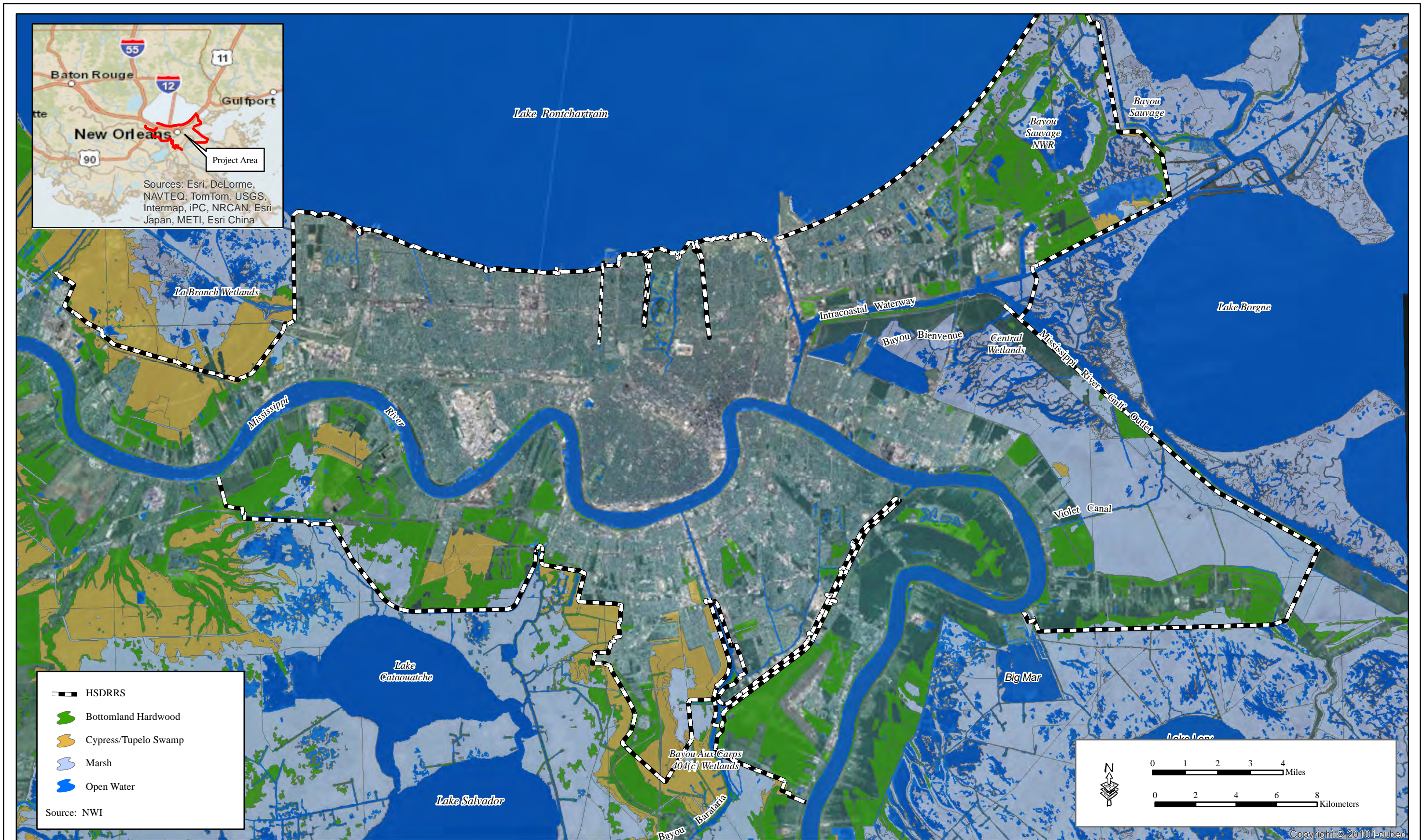


Figure 4-5: Wetlands within and adjacent to the HSDRRS Project Area

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Brackish and saline marshes in the project area, such as the wetlands communities near the Central Wetlands and the Golden Triangle areas, consist of emergent, herbaceous vegetation with areas of shallow open water and numerous canals and creeks. Brackish marshes experience low to moderate daily tidal action. Vegetation is typically dominated by smooth cordgrass (*Spartina alterniflora*), but also includes saltgrass (*Distichlis spicata*), black rush (*Juncus roemerianus*), and bulrush (*Schoenoplectus* spp.). Brackish marsh is found mainly within the Chalmette Loop sub-basin and extends northward into the eastern edge of the New Orleans East sub-basin (Sasser et al. 2008). Salt marshes are less floristically diverse, as they are dominated by only a few plant species that are tolerant of increased salinity levels, such as smooth cordgrass, saltgrass, and glasswort (*Salicornia virginica*) (USACE 2004a). There are very few saline marshes within the project area, and these are limited to the extreme southern coastal areas.

Bottomland Hardwood

BLH are defined as forested alluvial wetlands typically occupying floodplain regions of large flooding water bodies and rivers (Cowardin et al. 1979). They occur in areas where the natural hydrologic regime alternates between wet and dry periods. Common tree species found within these habitats include American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), water hickory (*Carya aquatica*), nuttall oak (*Quercus nutallii*), Chinese tallow (*Triadica sebifera*), and red maple (*Acer rubrum*). Understory species may include dwarf palmetto (*Sabal minor*), waxmyrtle (*Myrica cerifera*), deciduous holly (*Ilex decidua*), and swamp dogwood (*Cornus foemina*). Other common species that may be present include poison ivy (*Toxicodendron radicans*), trumpet creeper (*Campsis radicans*), pepper-vine (*Ampelopsis arborea*), and greenbrier (*Smilax* spp.). BLH provide important foraging areas and habitat for a variety of wildlife, but because of the fragmented, disturbed, secondary nature of the BLH within the project area, it is unlikely that many species would utilize the project area as a more expansive primary growth forest. Some areas classified as BLH in the HSDRRS are scrub/shrub habitat, and are dominated by waxmyrtle, eastern baccharis (*Baccharis halimifolia*), rattlebox (*Sesbania* spp.) and black willow (*Salix nigra*). Most of the BLH in the HSDRRS project area, including scrub/shrub habitat, are disturbed and contain large concentrations of invasive Chinese tallow trees.

In the HSDRRS project area, BLH occurs as both jurisdictional BLH habitat (i.e., regulated under Section 404 of the CWA) and non-jurisdictional BLH habitat. USACE mitigates for impacts on both jurisdictional and non-jurisdictional BLH habitat as required under WRDA 1986.

Cypress-Tupelo Swamps

Cypress-tupelo swamps are located in transitional zones between BLH and lower-elevation marsh or scrub/shrub habitats and flood on a regular basis. Cypress-tupelo swamps exist where salinities are very low (near zero), where there is minimal daily tidal action, and where it is usually flooded throughout most of the growing season. Bald cypress (*Taxodium distichum*) and water-tupelo (*Nyssa aquatica*) are the dominant vegetation within this habitat type, but Drummond red maple (*Acer rubrum* var *drummondii*), green ash, and black willow also occur. Water lily (*Nymphaea odorata*), pickerelweed, smartweed (*Polygonum punctatum*), and non-native alligator weed (*Alternanthera philoxeroides*) are also common.

Open Water Habitat

Lake Pontchartrain, borrow ditches on either side of the levees, the GIWW, the Mississippi River, and smaller bayous (e.g., Bayou Sauvage, Bayou St. John) are all open water bodies classified as jurisdictional waters of the U.S. Any dredging or deposition of fill material within Lake Pontchartrain or wetlands areas would require compliance with CWA Section 404 authorization from the USACE and Section 401 authorization from LDEQ. Lake Pontchartrain, a large, brackish shallow estuary located north of the HSDRRS (Environmental Atlas of the Lake

Pontchartrain Basin 2002) does support SAV, including wild celery (*Vallisneria americana*), widgeongrass (*Ruppia maritima*), slender pondweed (*Potamogeton perfoliatus*), Eurasian milfoil (*Myriophyllum spicatum*), and southern naiad (*Najas guadalupensis*) (Duffy and Baltz 1998). Historically, SAV was abundant on all shores of Lake Pontchartrain; however, the total area of SAV within Lake Pontchartrain has decreased by approximately 90 percent between 1954 and 1998 (Darnell 1961 and Burnes et al. 1993). Shoreline modification, increased water turbidity, and algal overgrowth have contributed to this decline (Cho and Poirrier 2000b). Salinity in the Lake Pontchartrain estuary ranges from 0.5 to 15 parts per thousand (ppt).

4.2.3.2 Impacts of HSDRRS

4.2.3.2.1 HSDRRS 2011 Impacts

Impacts on habitats from construction of the HSDRRS were analyzed using the WVA methodology. The WVA methodology is a quantitative, habitat-based assessment tool developed for use in determining wetland benefits of proposed projects submitted for funding under CWPPRA; however, the methodology is widely used to evaluate the impacts of projects on wetlands values. The results of the WVA provide a quantitative estimate of the positive or negative environmental effects of a potential project. Typically, for a USACE civil works project, the WVA is applied to the habitats that will be impacted by the project. The WVA is applied to potential mitigation plans to develop appropriate compensatory mitigation if net negative impacts are determined.

The WVA has been developed for application to several habitat types along the Louisiana coast, including fresh/intermediate marsh, brackish marsh, saline marsh, fresh swamp, barrier islands, and barrier headlands. A WVA Procedural Manual has also been prepared to provide guidance to project planners in the use of the various community models (Environmental Working Group 2006). Two other habitat assessment models for BLH and coastal chenier/ridge habitat were developed for use outside of CWPPRA.

Habitat quality is estimated through the use of community models developed specifically for each habitat type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index (SI) graph for each variable, which defines the assumed relationship between habitat quality and different variable values, and 3) a mathematical formula that combines the SI for each variable into a single value for habitat quality. That single value is referred to as the Habitat Suitability Index (HSI) (Environmental Working Group 2006).

An SI function describes the relationship between a measurable condition and fish and wildlife habitat quality, or 'suitability,' and can be used to predict habitat quality based on the value of the measured condition. This allows the model user to evaluate, through the SI, the quality of a habitat for any variable value. Each SI ranges from 0.1 to 1.0, with 1.0 representing the optimal condition for the variable in question. SI graphs are developed for each variable based on empirical data and observed relationships (Environmental Working Group 2006, Environmental Working Group 2009, Louisiana Department of Natural Resources [LDNR] 1994). The final step in model development is to construct a mathematical formula that combines all SIs into a single HSI value. The HSI values are a numerical representation of the overall or "composite" habitat quality of the particular habitat being evaluated. The HSI formula defines the aggregation of SIs in a manner unique to each habitat type depending on how the formula is constructed (Environmental Working Group 2006).

The net impacts of a proposed project are estimated by predicting future habitat conditions under two scenarios: future without-project (FWOP) and future with-project. Specifically, predictions are made as to how the model variables would change through time under the two scenarios. Through that process, HSIs are established for baseline (pre-project) conditions and for FWOP

and future with-project scenarios for selected target years throughout the expected life of the project. HSIs are then multiplied by the project area acreage at each target year to arrive at Habitat Units (HU). HUs represent a numerical combination of quality (HSI) and quantity (acres) existing at any given point in time. The HUs are then averaged over the project life to determine AAHUs. The impact of a project can be quantified by comparing AAHUs between the FWOP and future with-project scenarios. The difference in AAHUs between the two scenarios represents the net impact attributable to the project in terms of habitat quantity and quality (Environmental Working Group 2006). The same type of analysis is applied to proposed mitigation plans to develop appropriate compensatory mitigation for unavoidable project impacts.

Mitigation for impacts on open water habitats and the use of WVA models to evaluate such impacts will follow guidelines developed cooperatively between CEMVN, NMFS, and USFWS (see appendix S). Those guidelines are undergoing further refinement. The USACE anticipates completion of the guidelines prior to the release of any supplement(s) to the CED, and the final version of these guidelines will be included, as appropriate, in forthcoming NEPA documents. In general, mitigation for impacts on open water habitats would typically be limited to any fill that would permanently affect open water habitats classified as EFH or containing SAV; any excavation impact on open water habitats containing SAV, or designated as EFH where excavation would create permanent anoxic conditions in the affected area; any fill or excavation impact on open water habitats containing seagrasses; or any fill or excavation in open water habitat that is designated as oyster seed grounds by LDWF. However, mitigation for impacts on open water habitats would not typically be required for dredging in open water areas where no SAV is present (even if the affected area is designated as EFH), for filling of an open water area such that the area would not be converted to non-aquatic habitat, or where the impact on open water habitats would be less than 1 acre within a single open water area.

Construction-related impacts on wetlands included filling of wetlands, damage to wetlands vegetation, disturbance of wetlands through increased sedimentation, increased turbidity in tidal channels, and sedimentation in the adjacent drainage channels. After construction, wetlands that were not filled were expected to stabilize, allowing for suspended sediments to settle and vegetation to recolonize the area. Construction-related impacts also adversely affected open water habitats such as lake bottoms, canal bottoms, drainage ways, and bayous. Direct impacts from dredging included temporary increased turbidity, disruption of water bottoms from access channels and material stockpiles, and destruction of SAV. The use of BMPs minimized the potential for indirect adverse effects on wetlands and open water habitats from soil erosion, runoff, and sediment transport as a result of construction-related activities and the placement of materials in staging areas.

The estimated loss of wetlands and non-jurisdictional BLH habitats (in acres/AAHUs) for all the HSDRRS actions described by the CED are provided in table 4-6. Wetlands and non-jurisdictional BLH impacts from all the HSDRRS actions totaled 1,502.49 (824.02 AAHUs) and 3,625.81 acres (1,810.77 AAHUs), respectively. A direct, permanent loss of wetlands occurred on freshwater marsh, intermediate marsh, brackish/scrub/shrub marsh, saline marsh, BLH, and cypress-tupelo swamp habitats, and was a moderate permanent impact in all sub-basins, except in the Orleans East Bank sub-basin, where only negligible permanent impacts on wetlands occurred.

No direct impacts on jurisdictional wetlands occurred at the borrow sites. Direct, permanent impacts on non-jurisdictional BLH in borrow areas (table 4-6) included loss of wildlife habitat and foraging areas due to clearing and excavation. Trees were cleared and soils were excavated for borrow material, removing BLH habitats, and non-wetland habitats. In some borrow areas, open water habitat was created through the excavation of suitable material. The evaluation of impacts on non-jurisdictional BLH is ongoing, but as of September 2011, impacts on

approximately 117.15 acres (65.97 AAHUs) of non-jurisdictional BLH habitat were mitigated in association with the HSDRRS excavation of contractor-furnished borrow areas.

**Table 4-6. Wetlands¹ and Non-jurisdictional BLH Impacts from the HSDRRS²
(based on the USFWS CARs)**

Sub-basin/ IER* #	Approximate Areas of Wetlands Impacted (Acres)	Approximate Value of Wetlands Impacted (AAHUs)	Approximate Areas of Non- jurisdictional BLH Impacted (Acres)	Approximate Value of Non- jurisdictional BLH Impacted (AAHUs)
St. Charles				
<i>Risk Reduction</i>				
1/S 1	291.95	193.05	11	8.09
<i>Borrow</i>				
NA	NA	NA	NA	NA
Subtotal	291.95	193.05	11	8.09
Jefferson East Bank				
<i>Risk Reduction</i>				
2/S 2	34.00	22.00	0	0
3/S 3.a	0	0	0	0
<i>Borrow</i>				
29	0	0	0	0
Subtotal	34.00	22.00	0	0
Orleans East Bank				
<i>Risk Reduction</i>				
4	0	0	0	0
5	0	0	0	0
27	0	0	0	0
<i>Borrow</i>				
NA	NA	NA	NA	NA
Subtotal	0	0	0	0
New Orleans East				
<i>Risk Reduction</i>				
6/S 6	4.00***	0	0	0
7/S 7	245.00***	110.30	202.00	101.40
11 Tier 2 Borgne and S 11 Tier 2 Borgne	122.00	24.33	15.00	2.59
11 Tier 2 Pontchartrain	0	0	0	0
<i>Borrow</i>				
18	0	0	226.00	68.79
19	0	0	0	0
25	0	0	837	231.00
29	0	0	31.1	6.5
Subtotal	371.00	134.63	1,311.1	388.18
Chalmette Loop				
<i>Risk Reduction</i>				
8	0	0	0	0
9	1.90	1.20	10	4.65
10	429.59	267.27	73.63***	31.66
<i>Borrow</i>				

Table 4-6, continued

Sub-basin/ IER* #	Approximate Areas of Wetlands Impacted (Acres)	Approximate Value of Wetlands Impacted (AAHUs)	Approximate Areas of Non- jurisdictional BLH Impacted (Acres)	Approximate Value of Non- jurisdictional BLH Impacted (AAHUs)
18	0	0	115.4	69.23
19	0	0	0	0
28	0	0	8.05	4.35
30	0	0	225	189.40
Subtotal	431.29	286.47	432.08	299.29
Belle Chasse				
<i>Risk Reduction</i>				
13	58.00	38.86	13.00	7.80
<i>Borrow</i>				
18	0	0	8.00	3.68
22	0	0	0	0
Subtotal	58.00	38.86	21.00	11.48
Gretna-Algiers				
<i>Risk Reduction</i>				
12/S 12	77.10**	40.40	252.00	175.10
<i>Borrow</i>				
NA	NA	NA	NA	NA
Subtotal	77.10	40.40	252.00	175.10
Harvey - Westwego				
<i>Risk Reduction</i>				
14/S 14.a	71.75	17.02	90.5	67.17
<i>Borrow</i>				
NA	NA	NA	NA	NA
Subtotal	71.75	17.02	90.5	67.17
Lake Cataouatche				
<i>Risk Reduction</i>				
15	0	0	27.10	7.47
16/S 16.a	148.20	74.50	157.70	73.46
17	19.00	17.09	5.50	2.69
<i>Borrow</i>				
18	0	0	111.9	56.12
22	0	0	157.76	94.76
25	0	0	78.3	40.90
26	0	0	0	0
28	0	0	0	0
Subtotal	167.20	91.59	532.76	275.40
Outside HSDRRS Sub-basins				
Ascension Parish	0	0	0	0
East Baton Rouge Parish (31-Lilly Bayou Site)	0	0	356.10	242.72
Iberville Parish (19)	0	0	0	0
Lafourche Parish (31 Raceland Raw Sugars Site)	0	0	1.71	0.56
Plaquemines Parish	0	0	277.43	154.06
St. Bernard Parish (23)	0	0	0	0

Table 4-6, continued

Sub-basin/ IER* #	Approximate Areas of Wetlands Impacted (Acres)	Approximate Value of Wetlands Impacted (AAHUs)	Approximate Areas of Non- jurisdictional BLH Impacted (Acres)	Approximate Value of Non- jurisdictional BLH Impacted (AAHUs)
St. Charles Parish (23 and 32 3C Riverside Phase 3)	0	0	174.60	84.60
St. James Parish	0	0	0	0
St. John the Baptist Parish (24, 26, and 29 Willow Bend Phase II)	0	0	76.20	48.40
St. Tammany Parish	0	0	0	0
Hancock County, MS (19, 23, 26, 30, and 31 Port Bienville Site)	0	0	89.00	55.72
Subtotal	0	0	975.37	586.06
TOTAL****	1,502.49	824.02	3,625.81	1,810.77

¹ Impacts on wetlands affected the following habitat types: freshwater marsh, intermediate marsh, brackish/scrub/shrub marsh, saline marsh, forested marsh, and cypress-tupelo swamp.

²Includes all impacts for the HSDRRS components described by NEPA Alternative Arrangements in IERs completed by November 15, 2010, and by construction activities completed by July 2011.

*S - Supplemental

** Compensatory mitigation for the impacted 9.6 acres in the Bayou aux Carpes CWA Section 404(c) will be performed within the Bayou aux Carpes CWA Section 404(c); impacts and required mitigation reduced from this total through less ROW acquisition (IER Supplemental 12.a)

*** Impact for raising foreshore protection potentially in 2057 (4 acres for IER #6 and IER Supplemental #6 and 7.2 acres for IER #7 and IER Supplemental #7).

**** Total impact acres reflect only those impacts identified in IERs completed by November 15, 2010.

Indirect impacts on wetlands also occurred as a result of the HSDRRS. The closure of the canal west of Bayou Trepagnier (St. Charles sub-basin: IER #1 and IER Supplemental #1) reduced the amount of surface water that flows into the wetlands. In the New Orleans East sub-basin (IER #11 Tier 2 Borgne and IER Supplemental #11 Tier 2 Borgne and Pontchartrain), barriers constructed in the marsh had the potential to cause minor changes in hydrology or water circulation. Hydrologic models showed that inundation depth could increase +/- 2.4 inches. In addition, the model showed that inundation duration could change +/- 2 hours a day and be 10 to 15 days longer per inundation (USACE 2008j). Also in the New Orleans East sub-basin, placement of dredged material during construction decreased bottom depths in open water areas where the dredged material was placed. By January 2011 the CEMVN staff observed natural revegetation in the beneficial use area where bottom elevations had been developed that had the potential to support emergent vegetation.

Within the HSDRRS Chalmette Loop sub-basin (IERs #8, #9, #10, #18, #19, #28, #30), the construction of a cofferdam in Bayou Dupre reduced the tidal range and flow throughout the Central Wetlands Area during construction. Reductions in salinities due to temporary accumulation of rain and freshwater in the Central Wetlands Area would promote a transition of the wetlands in the area back towards a less saline condition. Hydrological modeling indicated that salinities in the Central Wetlands Area were 18 to 20 ppt in September 2006. When those conditions were compared to future conditions in which the MRGO was closed with no opening at Bayou Dupre, the model showed a reduction in salinity within the Central Wetlands Areas of approximately 4 ppt (IER #8). Modeling results indicated that with the MRGO closure and the Tier 2 Borgne barrier completed, the tidal range on the protected side of the barrier had the potential to be reduced by about one-half (approximately 8 inches).

Some areas had the potential to experience longer inundation periods and higher than normal tides, which could lead to vegetation shifts or conversion of some areas to shallow water. Other indirect impacts included increased compaction of wetlands soils, which leads to less percolation and flood storage because the water is trapped at the surface. This reduces water flow and water quality. Construction had the potential to cause changes to hydrology and inundation levels, which may lead to an indirect loss of marsh habitat through alterations such as changes in salinity and nutrient load.

The potential for indirect impacts on jurisdictional wetlands from borrow site excavation was described in several borrow IERs. However, after further review of each proposed borrow site location relative to jurisdictional wetlands, and with measures implemented to protect jurisdictional wetlands from borrow site excavation (such as maintaining a 100 ft upland buffer between wetlands and borrow excavation activities), it has been determined that no indirect impacts on wetlands occurred as a result of borrow site excavation. Upland buffers are routinely used to protect wetlands from indirect impacts of development activities. Castelle et al. (1994) conducted a literature search of buffer sizes recommended to protect wetlands in order to assist public agencies in making adequate wetland buffer size choices. A buffer size of 50 ft was recommended to be the necessary wetland buffer size to protect wetlands from development in most cases (Castelle et al. 1994). The excavation of borrow material within an upland environment surrounded by a 100 ft upland buffer would not dewater nearby wetlands. With an upland buffer separating wetlands from the borrow site, there is no surface water connectivity between the excavated borrow site and the wetlands. Water would not flow uphill over the upland buffer from the wetlands to the borrow pit, or vice versa. Groundwater is very near the ground surface at all of the borrow site locations. Therefore, the excavation of a borrow pit would not cause any dewatering of nearby wetlands through groundwater movement. With no surface water or groundwater connectivity between wetlands and the excavated borrow sites, an upland buffer, and normal construction BMPs during borrow site excavation, there would be no indirect impacts on wetlands.

While there were long-term adverse impacts on wildlife and water quality due to the construction of the HSDRRS projects, all impacts on wetlands and non-jurisdictional BLH habitat will be fully mitigated by restoration or creation of wetlands and non-jurisdictional BLH based on AAHUs. The USACE and USFWS agreed to base all compensatory mitigation in the Greater New Orleans Metropolitan Area on AAHU values resulting from WVA models, to be discussed further in the final Mitigation IERs. Except for the IER #31 borrow sites, the contractor-furnished borrow sites did not include final CAR reports because landowners or contractors were responsible for compensatory mitigation of impacts on non-jurisdictional BLH habitats. The USACE has committed to mitigate 824.02 AAHUs of wetlands and 1,810.77 AAHUs of non-jurisdictional BLH based on the most recent impact estimates, which may change as final construction footprints are determined and as-built plans are reviewed. Some work presented in the IERs was not performed for the HSDRRS 2011 and may or may not be performed in the HSDRRS 2057 effort; therefore, the final compensatory mitigation values are dynamic. However, the most current mitigation requirements can be found in appendix N, and are included in section 5.0, along with more detailed discussions on the mitigation project designs and implementation for wetlands and non-jurisdictional BLH.

4.2.3.2.2 HSDRRS 2057 Impacts

It is anticipated that a loss of wetlands would occur from the future levee lifts within the 35 HSDRRS project reaches projected to require additional construction, which would result in moderate, permanent impacts on wetlands. The permanent impacts on wetlands from future levee lifts can only be estimated because the changes in footprints for future levee lifts are not known at this time. Along 22 of 35 of the reaches scheduled for future levee lifts, jurisdictional wetlands are located immediately adjacent to levees, wetlands were impacted during levee

construction for HSDRRS 2011, and expanded footprints would be forced into those wetlands due to development on the protected side of the levee or open water on the flood side of the levee. It is estimated that approximately 154 additional acres of wetlands would be impacted by future levee lifts.

If the foreshore protection addressed in IERs #6 and #7 were implemented by the year 2057 within the New Orleans East sub-basin, then approximately 4 and 7.2 acres of impacts on wetlands and non-jurisdictional BLH, respectively, would occur.

Short-term disturbance of wetlands from additional levee lifts would include damage to adjacent wetlands vegetation and the potential for increased turbidity and sedimentation. The use of BMPs would minimize the potential for indirect adverse effects from soil erosion, runoff, and sediment transport as a result of construction-related activities and the placement of materials in staging areas.

4.2.3.3 Cumulative Impacts

4.2.3.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Approximately 5,128.3 acres of wetland and non-jurisdictional BLH habitats were lost as a result of the HSDRRS construction and an additional 154 acres of wetlands could be impacted by future levee lifts. The WVA analysis takes into account not only the direct loss of wetland habitats, but also the temporal loss of function between the time of impact and the time in which habitat is replaced. Therefore, with the implementation of wetlands mitigation, the direct cumulative impacts on wetlands and non-jurisdictional BLH would be moderate.

Indirect impacts from sedimentation and vegetation disturbance occurred during construction activities and are anticipated to continue periodically through 2057, as additional levee lifts and maintenance activities are implemented. The cumulative indirect impacts on wetlands are minor, because these are short-term disturbances to low-functioning wetlands located on the fringe of existing risk reduction structures.

Changes in floodgate operations or more frequent closures due to increased storm frequencies at any gated structure in the HSDRRS could be required in the future due to sea-level rise or changes in climate patterns. These changes cannot be predicted at this time, and may never be severe enough to force an operational change. However, any increase in the duration of HSDRRS floodgate closures would increase the depth and duration of flooding of the marsh, adversely impacting plant health and causing wetland loss.

4.2.3.3.2 Cumulative Impacts of Present and Future Regional Actions

Impacts of other ongoing and future regional actions are similar in many of the sub-basins and parishes affected by the HSDRRS. Specific conditions are listed by sub-basins and parishes below.

Storm Damage Reconstruction

Storm damage reconstruction projects would have little to no direct effects on wetlands or non-jurisdictional BLH habitat because most of the projects would be constructed within the current structural project footprints in previously disturbed upland areas. Additionally, it is not anticipated that indirect impacts would occur on wetlands from reconstruction projects because the majority of the work would occur in upland areas behind risk reduction structures.

Redevelopment

Ongoing and future redevelopment projects that occur in urban areas (e.g., City of New Orleans, LADOTD, parish government projects), where the land has already been highly modified and

disturbed, are not likely to impact wetlands or non-jurisdictional BLH habitat due to the urban setting.

Redevelopment projects that expand into more natural and undisturbed environments, such as harbors, marinas, pilings, camps, oil and gas pipelines, and water and sewer lines, could result in the direct loss of wetlands and non-jurisdictional BLH habitat. The 933 standard permits issued by CEMVN between July 2007 and June 2011 included projects that potentially impacted 1,299.2 acres of jurisdictional waters of the U.S. Loss of wetlands habitat as permitted by CEMVN Regulating Branch would require full compliance with the CWA and implementation of mitigation, where applicable. Indirect impacts due to redevelopment projects would include impacts similar to those mentioned in storm damage reconstruction.

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects provide benefits to wetland habitats regionally. The following are summaries of beneficial impacts on wetlands from restoration projects proposed in the HSDRRS area.

- St. Charles sub-basin - The Bonnet Carré Freshwater Diversion project, which is currently on hold pending an agreement between the states of Louisiana and Mississippi on an acceptable plan, would improve wetlands in the region by reducing saltwater intrusion and increasing the production of local fisheries such as oyster (*Crassostrea virginica*), white shrimp (*Litopenaeus setiferus*), blue crab (*Callinectes sapidus*), Atlantic croaker (*Micropogonias undulates*), and Gulf menhaden (*Brevoortia patronus*). It is estimated that 10,500 acres of marsh and swamps adjacent to Lake Maurepas and Lake Pontchartrain would be saved over the 50-year period of analysis (USACE 2011b).
- Jefferson East Bank and Orleans East Bank sub-basins - The MRGO closure and associated ecosystem restoration project would positively impact wetlands and habitat within Lake Pontchartrain by helping prevent high salinity waters from entering Lake Pontchartrain via the IHNC. The proposed restoration project would restore and protect 58,861 acres of habitat in the study area, including 13,950 acres of fresh/intermediate marsh, 33,966 acres of brackish marsh, 10,340 acres of cypress swamp, 455 acres of saline marsh, and 48 acres of ridge habitat. In addition, the proposed restoration includes 70 miles of shoreline protection in the MRGO, Lake Borgne, and Biloxi Marsh (USACE 2010a). This project is in the planning stages.
- New Orleans East sub-basin - The Bayou Sauvage NWR Hydrologic Restoration project Phase 1 and Phase 2 has been completed and resulted in 2,830 acres (1,104 AAHUs) of created, restored, or protected wetlands (CWPPRA 2011).
- Chalmette Loop sub-basin - The Violet Canal Freshwater Diversion is expected to have a significant beneficial effect on the water quality conditions of Central Wetlands area by diverting approximately 4,000 cfs of freshwater into the area and creating 49 acres (38 AAHUs) of marsh in shallow open water, in addition to protecting 207 acres of wetlands. It is expected to increase fine sediment transport and deposition into the marshes located between the Mississippi River and MRGO, thereby lowering the salinity in the Central Wetlands Area. The reduction in salinity may allow vegetation adapted to brackish conditions to expand its range and promote a transition of the wetlands back toward their natural, less saline condition. In addition, the project would include beneficial use of all excavated earth material to create marsh in shallow open water within the project area. The Caernarvon Diversion Outfall Management project would aid in the restoration of former ecological conditions by controlling salinity and supplementing nutrients and sediments to the area. This project could potentially prevent 95 percent of the marsh loss predicted for the next 50 years within Breton Sound (LCWCRTF and Wetlands

Conservation and Restoration Authority 1998). Approximately 802 acres (504 AAHUs) of wetlands would be created or restored. Both of these proposed projects are in the planning stages.

CWPPRA projects would create, restore, or protect 3,528 acres of barrier island habitat and 7,662 acres of marsh habitat. In addition, marsh would be created, restored, or protected through CWPPRA freshwater diversion projects (5,918 acres) and hydrologic restoration projects (5,601 acres) (CWPPRA 2011). Shoreline protection, outfall management, terracing, and herbivory control projects would contribute additional benefits to area wetlands.

Flood Risk Reduction Projects

Flood risk reduction projects would contribute to additional loss of wetlands through the filling of wetlands due to levee and floodwall expansion. Some projects may have long-term positive effects, such as reducing the likelihood of storm surges converting marsh into open water. Storms can erode fragile, floating marshes, and storm surges can push salt water into fresh marshes, killing the vegetation and thus converting marsh habitat into open water. In general, the loss of wetlands habitat due to ongoing and future flood risk reduction projects is a small fraction of the wetlands habitat in Louisiana, but any permanent loss is considered significant. All direct and indirect impacts on wetlands would be mitigated as required by Section 404 of the CWA. Non-jurisdictional BLH habitats could be lost without mitigation; however, USACE mitigates for all impacts on BLH habitats. Construction-related surface water runoff would increase turbidity and sedimentation in streams, canals, drainage ways, and lakes in the vicinity of the projects, but most of these impacts would be temporary during the length of construction and would be minimized with the use of BMPs. Present and future regional flood risk reduction projects include the following:

- Plaquemines Parish New Orleans to Venice Federal Levee System - This project would result in direct, permanent loss of 366.51 acres of wetlands, 146.62 acres of waters of the U.S., and 10.87 acres of other waters in the project area (USACE 2011d). In addition, the levee improvements would result in short-term water quality impacts, such as increased turbidity and sedimentation.
- Larose to Golden Meadow, Louisiana Hurricane Protection Project - Originally, it was estimated that approximately 2,750 acres of marsh habitat would be permanently impacted by this project (USACE 1973). Wetlands would be drained and marsh vegetation, SAV, and wildlife (e.g., shellfish, benthic organisms, and fish) would be destroyed. In addition, the area could no longer be utilized for breeding, foraging, or nursing habitat for a variety of aquatic species and birds. In 1990, Section D-North was proposed for realignment, resulting in additional impacts on 179 acres of marsh, drained marsh, and levee forest (USACE 1991).
- Morganza to the Gulf - This project would directly affect 4,112 acres of wetlands, and compensatory mitigation would be necessary for the direct loss 1,352 acres of fresh (211 AAHUs), brackish, and saline marshes (804 AAHUs) (USACE 2002). Approximately 15 of the 72 miles of proposed levee would cross estuaries that are currently open to estuarine exchange, but several water control structures in the levees would allow hydrologic exchange.
- Grand Isle - It was originally assumed that 700 acres of nearshore bottoms would be adversely impacted as a result of this project, and that a loss of 400 acres would occur over 6.5 years (USACE 1979). Temporary impacts included increased turbidity in the water during dredging and construction. Dredging could result in damage to SAV and destroy non-mobile aquatic benthic organisms. Stockpiling of sand and clay would impact beach habitat, intertidal flats, and shallow estuarine waters.

- SELA - Wetlands impacts from this project would include temporary loss of established benthic habitats either through dredging or by replacing natural substrates with cement. Sediments would settle over time and provide some habitat, even on man-made substrates. Vegetation removal in canals and canal edges would cause temporary impacts on wetlands habitats by increasing water temperatures, decreasing available DO in the water, and by decreasing the amount and quality of available terrestrial wetland habitat surrounding the canals. Riprap placed on the canal banks may hinder vegetation growth. Mobile aquatic species would be displaced, but would recolonize after construction is complete.
- IHNC Lock Replacement - Environmental impacts from this project would include the loss of 25 acres of freshwater marsh that would require compensatory mitigation. In addition, low-quality wetlands, upland scrub/shrub habitat, and as much as 2.8 acres of drained, wooded land would be impacted for use as a disposal site or construction of a detour road, but these habitats would not require compensatory mitigation.

Transportation

Transportation projects would have minor cumulative effects on wetlands or non-jurisdictional BLH habitat due to the fact that most of the projects are being constructed in previously disturbed areas. Further, if unavoidable impacts should arise, CWA Section 404 evaluations, permitting activities, and implementation of mitigation measures (avoidance, minimization, and compensation) would minimize long-term cumulative impacts on wetlands, but may not provide mitigation for non-jurisdictional BLH habitats.

- I-49 Construction - A total of 578.9 acres of wetlands, including non-jurisdictional BLH, cypress/tupelo swamp, wet pasture, marsh, and scrub/shrub habitat, would be impacted by the development of I-49. Impacts would be on hydrology (e.g., leveed, pumped or artificially constricted) and vegetation (e.g., logged or cleared). Elevated roadways would shade wetlands areas and would not support trees. The construction of I-49 would generate typical roadway pollutants that could flow into drainage ways. Construction could also result in increased turbidity in local waters (LADOTD 2007).
- Huey P. Long Bridge Widening - This project could impact 1.57 acres of wetlands habitat due to the placement of new piers. These wetlands would be removed for the construction of the piers, but most of the area should naturally revegetate after piers are constructed (LADOTD 2005).
- I-10 Twin Span Bridge over Lake Pontchartrain - This project would impact 4.6 acres of wetlands; 3.7 acres of estuarine intertidal scrub/shrub brackish marsh on the south shore in Orleans Parish, and 0.9 acre of freshwater forest scrub/shrub marsh on the north shore in St. Tammany Parish (Federal Highway Administration [FHWA] 2006).
- Florida Avenue Bridge over IHNC - This planned LADOTD project would impact 1.99 acres of wetlands and 49.45 acres of other waters of the U.S., of which 1.28 acres are within the Florida Walk Canal. Impacts on wetlands would be negligible because the roadway would be elevated and no changes to present hydrological conditions are planned. Wetlands vegetation would reestablish along and under the bridge once construction is complete.
- I-12 to Bush, Louisiana - This planned LADOTD Louisiana Highway (LA) 3241 from the LA 40/41 intersection in Bush, St. Tammany Parish, Louisiana, to Interstate 12 (I-12) could impact between approximately 586 and 862 acres of wetlands and pine flatwoods based on the alternative alignment chosen.

4.2.3.3.3 Summary of All Cumulative Impacts for Wetlands

The loss of wetlands in southeastern Louisiana has been primarily caused by large-scale flood risk reduction and navigation projects. The course of the Mississippi River and its ability to flood coastal marshes and estuaries with sediment-rich waters has been altered through channelization and levee construction projects. Large-scale flood risk reduction projects that continue to be constructed regionally contribute to coastal wetland loss. The cumulative impact on wetlands from past, ongoing, and future projects in the region is major and significant, and only through mitigation measures such as best management practices can these impacts be reduced. Coastal and wetlands restoration creation projects have provided some measures for combating the loss of wetlands, but the size of these projects has been small relative to the scale of projects that have contributed to wetland loss. Future large-scale restoration projects proposed by the state and Federal governments would cumulatively provide a major benefit to wetlands in the region but are not likely to fully offset the cumulative adverse impacts of historic flood risk reduction projects.

Indirect cumulative impacts include alterations to habitats and hydrology, which could result in changes to salinity and nutrient loads in local wetlands, leading to additional wetlands loss. Flood risk reduction projects and other regional projects occurring near wetlands would cause damage to adjacent wetlands vegetation (including SAV) and increase turbidity and sedimentation in the adjacent wetlands habitat and drainage canals.

4.2.4 Uplands

4.2.4.1 Affected Environment

Uplands are essentially lands that do not contain wetlands or open water; however, they are not necessarily located on higher ground than adjacent wetlands or open water if they are maintained with forced drainage. In the HSDRRS project area, uplands can also encompass drained former wetlands, although they are not always considered natural in terms of impact assessment.

Typical upland habitat found in the project area consists of BLH communities, scrub/shrub communities, and natural and artificial levee high ground. Drained former wetlands, as well as developed and urban areas, are uplands but are not habitats of concern, as they both have already been altered from their natural state. Non-wetland BLH are areas that lack one of the three characteristics that define wetlands (wetlands hydrology, hydrophytic vegetation, or hydric soils). A variety of birds utilize BLH habitat for breeding, nesting, and as perches. The BLH species are also nutritional food sources for birds, mammals, and other wildlife species. A more thorough discussion of BLH is found in section 4.2.3. Scrub/shrub communities contain woody vegetation that is less than 20 ft tall and covers more than 20 percent of the given area (NOAA 1995). Scrub/shrub uplands can develop in disturbed areas, openings in BLH, in areas that have experienced storm damage or disease disturbances, as part of BLH, and in areas of urban decay. Similar species of woody vegetation can be found in scrub/shrub habitat as is found in BLH, as well as southern dewberry (*Rubus trivialis*), eastern baccharis, wax myrtle, red mulberry (*Morus rubra*), pepper-vine, and giant ragweed (*Ambrosia trifida*). The invasive species, Chinese tallow, is commonly found in the scrub/shrub habitat in this area (Louisiana Natural Heritage Program [LNHP] 2009).

Uplands, prior to human development, were found along the natural levees and other land built by the various deltaic lobes of the Mississippi River. Natural levees were mostly forested, or used for farmland when humans settled the region. The adjacent batture (land between the levee and the river) often had scrub/shrub habitat that would seasonally flood. This seasonally flooded land was often used for farmland. As farms and cities developed on uplands, the natural vegetation was cleared, leaving scattered bands of native upland habitat along the natural levees. In order to protect their homes and farms from flooding, private landowners built levees on their property. Municipalities also built levees to protect citizens and developed areas from floods.

Prior to 1879, levees were maintained locally, resulting in varying heights and uplands being created or distressed sporadically as water responded to the man-made levees. In 1879 the Mississippi River Commission was created to survey and create plans for the river and its distributaries. The commission followed a “levees only” practice for the river and began to standardize levee-building practices (Colton 2000).

Levee regulations in south Louisiana’s modern history (pre-Hurricane Katrina) required levees to be turf-covered and maintained (mowed) to prevent tree growth on the levee and within an easement (or ROW) on either side of the levee of at least 15 ft. These regulations allowed for stability of levee soils and ease of inspection for safety purposes. The maintenance regulations along with patterns of development and urbanization have facilitated further isolation of uplands, including the associated natural habitat, in southeastern Louisiana.

4.2.4.1.1 Existing Conditions

Isolated areas of BLH remain, as do a few remaining drained and undeveloped marshes. Much of the levee forest cleared for agriculture and later abandoned is now a scrub/shrub or old field habitat characterized by disturbance-tolerant species. Limited forested and scrub/shrub habitats within the study area provide habitat for resident passerine birds and essential resting areas for many migratory songbirds. The HSDRRS and MRL levee corridors are predominantly maintained turf grasses with occasional pockets of natural vegetation along the interface between the maintained levee and wetlands areas.

Currently, the levees found in the HSDRRS project area are maintained, and those that failed during Hurricane Katrina have been reinforced to pre-Hurricane Katrina status, or to the 100-year level of risk reduction. There are more areas of scrub/shrub habitat found scattered throughout the project area due to abandoned homes/lots, but they are not considered uplands of concern because they were previously developed and previously had major changes to the habitat and soils.

4.2.4.2 Impacts of HSDRRS

4.2.4.2.1 HSDRRS 2011 Impacts

When considering the impacts on uplands in the HSDRRS project area (excluding borrow areas), the area of permanent impacts was small (approximately 49 acres) when compared to the hundreds of thousands of acres of uplands, both developed and undeveloped, in the entire project area (table 4-7). Much of the project area’s uplands were created by drainage and infill or were otherwise altered by human development. The majority of upland habitat within the levee ROW was artificially created and generally consists of the levees themselves. Disturbance to uplands occurred in the construction ROWs.

Impacts on uplands were primarily due to HSDRRS construction activities. Often, temporary impacts occurred from staging and equipment access areas that were located outside the HSDRRS structures’ ROW (e.g., nearby upland field or parking lot), and where floodwalls were constructed, the ROW in the area was already disturbed. Levees that were raised (which increased the footprint) were also in existing, previously disturbed ROWs, and impacts on uplands were negligible. Further, they were revegetated once construction was complete. In a few cases, vegetation in the upland areas was removed, and stands of trees or scrub/shrub were forfeited to the project. Direct impacts on uplands from HSDRRS construction totaled 49 acres, and temporary impacts were 1,153.6 acres. Most (96 percent) of these impacts were temporary and occurred within the Chalmette Loop (table 4-7).

Table 4-7. Impacts on Uplands for the HSDRRS Projects Evaluated in the CED by Sub-basin¹

Sub-basin	Permanent Direct Impacts (acres)	Temporary Direct Impacts (acres)
St. Charles	0	0
Jefferson East Bank	0	0
Orleans East Bank	0	0
New Orleans East	26	72.6
Chalmette Loop	10	1,081
Belle Chasse	13	0
Gretna-Algiers	0	0
Harvey-Westwego	0	0
Lake Cataouatche	0	0
Totals	49	1,153.6

¹Impacts on uplands occurred primarily to scrub/shrub habitats on the periphery of existing levees and to turf grass on existing levees. For some IERs, impacts on uplands that comprised the existing levee footprint were not described.

Throughout the HSDRRS, there are uplands that have been created by draining wetlands and placement of fill and uplands that occur naturally. Non-wetland areas created by spoil and infill from construction projects were not evaluated further by the HSDRRS IERs. Uplands that were formed by natural means, which are now covered by human development, were considered previously impacted, and were not evaluated further by the HSDRRS. Permanent impacts on uplands in all sub-basins, except the New Orleans East and Chalmette Loop sub-basins, were negligible.

In the New Orleans East sub-basin, minor permanent impacts on uplands occurred through the conversion of 26 acres of maintained turf grass and developed lands to new levees, floodwalls, and floodgates as described in IER #6. Additionally, temporary construction impacts occurred on a total of 62.5 acres within LPV-105, 106, and 107. Also in this sub-basin, there were temporary impacts on approximately 10 acres of maintained turf on levee slopes during construction activities as described by IER #7.

In the Chalmette Loop sub-basin, minor permanent impacts occurred on approximately 10 acres of natural levee ridges. Additionally, approximately 1,081 acres of temporary impacts occurred on uplands due to construction. Primarily, these temporary impacts occurred on the pasture/turf grass (1,055 acres), while the remaining impacts occurred on scrub/shrub (23 acres) and upland forests (3 acres). In the Belle Chasse sub-basin, permanent impacts occurred on 13 acres of previous pasture land. Impacts occurred on upland areas composed of levees in other sub-basins; however, different methods of determining impacts on uplands in various IERs did not provide a quantification of these impacts.

A vegetation-free (i.e., no trees or shrubs) zone exists around all USACE levees, floodwalls, and other flood risk reduction structures (ETL 1110-2-571) and applies to all vegetation except grass used for erosion control. The primary purpose of a vegetation-free zone is to maintain access to flood risk reduction structures, thereby reducing reliability risk to these structures. A secondary purpose is to further minimize reliability risks due to tree root impacts on flood risk reduction structures as shown in photograph 4-1. More information on the vegetation-free zone can be found in section 5.0.



Photograph 4-1. Impacts on an earthen levee from tree roots.

The greatest impacts on uplands associated with construction of the HSDRRS occurred from the excavation of borrow areas, where uplands were chosen for borrow removal as jurisdictional wetlands were systematically avoided. Borrow areas consist primarily of agricultural lands (e.g., sugarcane fields, pasture), fallow agricultural lands, pine plantations, dry BLH, existing borrow sites, or formerly developed land (e.g., golf course at Eastover). The excavation of the land removed all vegetation and habitat for upland species and, in many cases, converted uplands to open water, and was a minor impact on uplands regionally. This removed all cover for wildlife, as well as herbaceous plants that herbivores use for food. Some borrow sites may not fill in with water, and these areas, as well as the disturbed edges of the new water features, have the potential for scrub/shrub species to develop from the existing seed bank or introduction of seed from wind or other common introduction methods (e.g., animals, construction machinery). The indirect adverse effect was the potential for unchecked growth of Chinese tallow and other invasive plant species.

There were no specific mitigation measures for the direct impacts on uplands (other than non-jurisdictional BLH habitat, which will be mitigated) from the HSDRRS construction, excluding the borrow sites, due to the degraded condition of uplands in the project area. Mitigation efforts implemented by the USACE to minimize upland impacts are discussed in section 5.0.

4.2.4.2.2 HSDRRS 2057 Impacts

Approximately 7.3 million cy of borrow would be needed for future levee lifts. Most of the impacts from removing this volume of material at borrow sites would potentially occur within upland habitats, and would be a minor permanent impact on uplands. Any new borrow areas would be cleared of existing vegetation, excavated, and most likely converted to open water habitat, reducing forage and breeding habitat for wildlife. However, due to limitations associated with authorization, NEPA compliance, and real estate acquisition requirements, borrow sites cleared for HSDRRS 2011 work would not necessarily be used for future levee lifts. Until borrow areas are selected, exact impacts on upland resources cannot be analyzed. No substantial impacts on upland habitats are anticipated within the footprint of levees from future levee lifts and HSDRRS structural maintenance activities.

4.2.4.3 Cumulative Impacts

4.2.4.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

The HSDRRS construction and future levee lifts, including the excavation of borrow material, and larger footprints for levee and floodwall construction would have moderate adverse, long-term cumulative impacts on upland resources. It is anticipated that most of the staging and stockpile areas used for the 2011 HSDRRS construction would be used along the 35 HSDRRS levee reaches scheduled for future levee lifts, and impacts from future HSDRRS staging and stockpiling activities would be negligible.

Upland areas were cleared of existing vegetation, excavated or filled, and converted into risk reduction structures and ponds or small lakes at many borrow areas. Cumulatively, the upland areas no longer provide foraging areas for herbivores, and the thick scrub/shrub vegetation that provided cover for wildlife is permanently lost.

4.2.4.3.2 Cumulative Impacts of Present and Future Regional Actions

Storm Damage Reconstruction

Storm damage reconstruction projects generally occur in the previously disturbed project footprints. As such, these projects had negligible impacts on uplands or the representative upland species, as the upland habitats had already been disturbed and altered.

Redevelopment

In portions of the HSDRRS project area that are urban and industrial, such as New Orleans East Bank and Jefferson East Bank, impacts on upland resources from redevelopment projects would be negligible. However, in areas where development is limited, such as Chalmette Loop and borrow areas in Plaquemines Parish outside the sub-basins, new residential and industrial development would impact uplands by removing uplands that provide biological production and wildlife foraging and breeding habitat and converting them to infrastructure.

Coastal and Wetlands Restoration

Restoration of coastal and wetland habitats would stabilize upland areas along the banks of water bodies and provide protection from wave erosion. In general, uplands would not be adversely impacted by these projects, as open water habitats are restored to wetlands. With the protection provided by restored coastlines and wetlands, uplands would indirectly benefit, as the threat of saltwater inundation and erosion would be reduced.

Flood Risk Reduction Projects

Upland habitats would be impacted by projects that create new flood risk reduction structures (levees and floodwalls) in a manner similar to the impacts found in the HSDRRS projects. Increased footprints of larger structures would occur on adjacent uplands, changing the habitat to levee or floodwall. Beneficial impacts on uplands would occur with a reduced risk of inundation from storm events when such projects are complete. Borrow material needed for levee construction would permanently convert uplands to open water habitats. Uplands would also be temporarily impacted during the construction phase by temporary roads and staging grounds covering upland habitats. With the completion of flood risk reduction projects, uplands would be indirectly impacted by increased development due to the reduced flood risk.

- New Orleans to Venice Federal Levee System - This project has little potential to impact upland resources within the project corridor, and there would be no adverse, significant impact on upland resources. However, site preparation and construction disturbances could cause temporary adverse impacts through the spread and propagation of viable seed sources of non-native and invasive plant species.
- Larose to Golden Meadow, Louisiana Hurricane Protection Project - Areas of woodland would be converted into levees and other risk reduction structures. Reduced risk would encourage the conversion of pasture and scrub/shrub communities into developed use.
- Morganza to the Gulf - Approximately 100 acres would be impacted by the removal of materials for levee construction from upland resources, and the land would no longer be used for farming or pastures (USACE 2002).
- Grand Isle - No impacts on upland resources would occur, because all construction activities take place on the beach.
- SELA - Urban lands would be directly impacted through excavation and construction activities. Landscaped areas along streets and sidewalks would be damaged or removed during construction. However, streets, sidewalks, and landscaped areas damaged during construction would be rebuilt and replaced following construction activities.
- IHNC Lock Replacement - Low-quality upland scrub/shrub habitat would be impacted for use as a dredging disposal site. In addition, 2.8 acres of drained, wooded land could be cleared for the construction of a detour road.

Transportation

Besides the planned I-12 to Bush project, which would extend across approximately 17 to 20 miles of relatively undeveloped areas of northern St. Tammany Parish, most transportation improvement projects would occur in previously disturbed corridors; therefore, only minor impacts on upland habitats would occur. Projects that are being constructed where uplands have not been previously disturbed would have adverse impacts on the resource. As with flood risk reduction projects, construction footprints would permanently disturb upland habitats. Temporary impacts from access roads and staging areas would occur during construction.

4.2.4.3.3 Summary of Cumulative Impacts for Uplands

Even though minimal in size when compared to the regional extent of forested and grassland habitats directly and indirectly affected by previous development activities, the excavation and use of borrow material in the project area, in combination with other past, present, and future large-scale construction projects, would cumulatively lead to the loss of upland habitats within southeast Louisiana. Based on historical human activities and land use trends in the area, it is reasonable to anticipate that future activities would further contribute to cumulative degradation of the land resources and, ultimately, upland habitats. In southeast Louisiana, most development occurs in the upland areas, which compose a relatively small portion of the surface area of the region. Most of southeast Louisiana is composed of wetlands, open water, and estuarine habitats, and undeveloped and undisturbed upland areas are relatively rare. Therefore, the cumulative loss of upland area that functions as habitat for wildlife and provides forested resources is a long-term, moderate cumulative impact.

4.2.5 Fisheries

4.2.5.1 Affected Environment

This resource is institutionally significant because of the Fish and Wildlife Coordination Act of 1958, as amended. Fisheries resources are technically significant because 1) they are a critical element of many valuable freshwater and marine habitats, 2) they are an indicator of the health of various freshwater and marine habitats, and 3) many species are important commercial and recreational resources. Fisheries resources are publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value.

Archaeological evidence, such as the discovery of large shell midden communities present in southeast Louisiana, reveals that residents have depended on coastal aquatic species for thousands of years (White et al. 2005). In 1774, an early traveler to Louisiana, Le Page du Pratz, noted that shrimp were being fished in the lakes south of New Orleans with large nets brought from France (Landry 2009). Using small skiffs or wading in shallow waters, shrimp were caught with seine nets in the shallow coastal lakes and bays and along the beach. In the early years, shrimp was largely a product sold fresh in local markets. In the late 1800s, Chinese immigrants introduced drying platforms for small shrimp, and exportation to markets in Asia began. The development of can liners improved canning techniques, and by 1880, the market for shrimp was greatly expanded. As catch size increased to meet a growing consumer demand, shrimp trawling emerged as an important occupation in Louisiana during the 20th century (Landry 2009).

The use of gasoline engines in the early 1900s expanded fishing into deeper waters and dramatically increased seafood yields (Louisiana Division of the Arts 1999). In 1917, the otter trawl, still in use today, was introduced to the Gulf Coast region from the Atlantic fisheries that first tested it along the Carolina coast (Louisiana Division of the Arts 1999). The introduction of reliable diesel engines in the 1930s enabled fishermen to make longer trips. Louisiana waters have always yielded the largest quantity of seafood in the Gulf of Mexico. The four most important seafood commodities in Louisiana are shrimp, blue crab, menhaden, and oyster (NOAA 2010). Many of the seasonal shrimpers live in settlements along the bayous of South Louisiana and the lower Mississippi River. Many fishermen come from a tradition of fishing and

shrimp trawling during the spring, summer, and fall months, followed by oyster raking and fur trapping during the winter months (Louisiana Division of the Arts 1999).

4.2.5.1.1 Existing Conditions

The freshwater habitats within the MRL system are highly valued by sport fishermen who pursue freshwater species such as largemouth bass (*Micropterus salmoides*), alligator gar (*Atractotenus spatula*), channel catfish (*Ictalurus punctatus*), white crappie (*Pomoxis annularus*), black crappie (*Pomoxis nigromaculatus*), various species of sunfish (*Lepomis* spp.), blue catfish (*Ictalurus furcatus*), flathead catfish (*Pylodictis olivaris*), spotted gar (*Lepisosteus oculatus*), and red swamp crawfish (*Procambarus clarkii*).

Lake Borgne and Lake Pontchartrain are more brackish and provide habitat to a wide variety of economically important invertebrates such as brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), white shrimp (*Litopenaeus setiferus*), blue crab (*Callinectes sapidus*), and oyster (*Crassostrea virginica*). Estuarine fish such as red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), sheepshead (*Archosargus probatocephalus*), speckled trout (*Cynoscion nebulosus*), and Atlantic croaker also inhabit the brackish water habitat. Additionally, Louisiana's estuarine habitat produces many species of fish that are not harvested for recreation or as commercial seafood. These fish contribute to the fisheries food web by serving as prey species for predators along the coast and offshore. These prey species include rainwater killifish (*Lucania parva*), naked goby (*Gobiosoma bosc*), Gulf pipefish (*Syngnathus scovelli*), clown goby (*Microgobius gulosus*), pinfish (*Lagodon rhomboides*), bay anchovy (*Anchoa mitchilli*), speckled worm eel (*Myrophis punctatus*), striped mullet (*Mugil cephalus*), Gulf menhaden, and Gulf killifish (*Fundulus grandis*).

Bay anchovy are the most abundant fish in Lake Pontchartrain and serve an important ecological function as a prey species for many commercial fisheries (O'Connell et al. 2004). The diversity of aquatic species makes the protection of Lake Pontchartrain fisheries important to Louisiana's economic future. Due to the extensive decline of Louisiana's coastal marsh, protection of fragile aquatic habitat is a concern for all large construction activities.

South and southwest of the HSDRRS project area in environments such as Lake Cataouatche, Lake Salvador, and adjacent marsh and tributaries, the surface waters are seasonally brackish with some aquatic inhabitants tolerant of both fresh and saline environments (osmoregulators). Observations by biologists indicate that marine fish such as bay anchovy, striped mullet, threadfin shad (*Dorosoma petenense*), tidewater silverside (*Menidia peninsulae*), and blue crab have been found in the main body of water in Lake Cataouatche. Freshwater fish such as sunfish, channel catfish, and largemouth bass were observed in swamp and marsh habitats, where the surface water contains an abundance of aquatic vegetation (Shultz 2006, Swarzenski et al. 2004).

Commercial Fisheries

The estuarine area surrounding the HSDRRS creates prolific nursery grounds for white and brown shrimp, blue crab, oysters, and menhaden. These important fisheries contribute to a significant portion of the annual commercial fishing landings in Louisiana. Commercial fish landing data for Louisiana from 2003 through 2011, the most recent year in which data are available, were collected from NOAA Fisheries (2013) and used for the following analyses. The commercial fisheries in Louisiana produced 503,480 tons per year with an annual economic value of \$275.24 million (median values 2003 through 2011; NOAA Fisheries 2013). Prior to the BP Deepwater Horizon oil spill, data collected revealed that commercial fishing vessels directly employed 26,474 fishermen and provided economic benefits in several supporting sectors such as boat building and repairs, net construction, and value-added seafood items. Cumulatively, commercial fisheries generated \$2.4 billion in economic benefits per year in the

Louisiana economy (Southwick Associates, Inc. 2008). Table 4-8 presents the six species of fish and invertebrates that provided the greatest economic impact on Louisiana fisheries prior to the BP Deepwater Horizon oil spill.

Table 4-8. Percent Value Annual Landings (Median) by Species Prior to the BP Deepwater Horizon Oil Spill

Percent Value of Louisiana Annual Commercial Fishery Landings (2003-2008)	
Species	Percent of Harvest (%)
White Shrimp	35
Brown Shrimp	16
Blue Crab	12
Menhaden	13
Oyster	13
Total	89

Source: NOAA Fisheries 2009

Statewide, a total of 39.3 million pounds of brown shrimp, 52.9 million pounds of white shrimp, and 43.9 million pounds of blue crab were landed in 2011, with an estimated economic value to fisheries of \$34.7 million, \$98.7 million, and \$36.8 million, respectively (NOAA Fisheries 2013). This compares to a total of 24.9 million pounds of brown shrimp, 63.1 million pounds of white shrimp, and 41.7 million pounds of blue crab landed in 2008, the last year before the BP Deepwater Horizon oil spill, with an estimated economic value to fisheries of \$22.7 million, \$107.4 million, and \$32.3 million, respectively (NOAA Fisheries 2013). NMFS annual shrimp landing data from 1988 through 2000 indicated a continued trend of brown shrimp landings greater than those of white shrimp in the collective areas of Lake Pontchartrain and Lake Borgne. In 1985, NMFS reported exceptionally high landings of brown shrimp, and peak landings of brown shrimp and white shrimp were similar to those observed in the 1970s. The high landings could be the result of the freshwater flushing of local wetlands during the 1983 flooding of the area (USACE 1998).

The blue crab is an important commercial species for the Lake Pontchartrain and Lake Borgne basins. Additionally, a total of 12.1 million pounds of oyster were harvested in 2004, with an estimated value of \$33.3 million (USACE 2004b). Louisiana oyster production has remained relatively stable for over 50 years; however, present-day stressors on the Louisiana oyster industry are threatening the long-term sustainability of both the industry and the resource. Coastal land loss and saltwater intrusion are reducing the amount of protective marsh. Additionally, increased salinity in coastal environments can promote rapid stress on oyster reefs from disease and predation (i.e., oyster drill) (Soniati et al. 2004).

Recreational Fisheries

In Louisiana, coastal and offshore recreational fishing stimulates \$757 million in economic output and creates 7,733 jobs (Southwick Associates, Inc. 2008). National fisheries statistics includes catch by year, species, and fishing mode for all available species caught by recreational activities from 2003 through 2008. The largest harvests of marine recreational fish species by weight in Louisiana were red drum, speckled trout, black drum, sheepshead, white seatrout (*Cynoscion arenarius*), king mackerel (*Scomberomorus cavalla*), and red snapper (*Lutjanus campechanus*) (NOAA Fisheries 2009). Red drum, red snapper, and king mackerel are Federally managed species. The total weight of annual fishing landings for a variety of species can be found in table 4-9.

Table 4-9. Annual Fishery Landings in Louisiana (Median Value from 2003 through 2008) for Recreational Fisheries

Louisiana Annual Landings (2003-2008) for Popular Recreational Catch		
Species	Total Recreational Catch (Number)	Total Recreational Catch (lbs)
Blue crab	Not applicable	737,953
Red drum	5,417,500	10,352,363
White seatrout	14,135,500	10,013,847
Black drum	1,254,500	2,146,419
Red snapper	229,500	480,269
King mackerel	264,000	57,280

Source: NOAA Fisheries 2009

4.2.5.2 Impacts of HSDRRS

4.2.5.2.1 HSDRRS 2011 Impacts

General HSDRRS Impacts

The general HSDRRS impacts on fisheries and fish habitats included effects on migratory movements, active/passive transport of eggs and larvae, nursery habitat recruitment of larvae and juveniles, changes in water characteristics (e.g., temperature, salinity, turbidity, and DO), organism access to biotic water quality habitats (e.g., protection from predators and food availability), and hydrology and velocity. These general HSDRRS impacts were associated with the actual construction activities, the associated dredge, fill, and material stockpiling activities, water body displacement, and hydrologic modifications of waterways and ecosystems.

Construction Activities

Construction activity causes sedimentation and contamination of waterways from stormwater runoff during rain events. Alterations in water quality from sediment loading adversely impacted fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fish and other aquatic organisms from sediment suspension and siltation in waters adjacent to the HSDRRS area included clogged gills, reduced growth rates, and disruption of egg and larval development (USEPA 2003).

Construction activities associated with the removal of emergent and overhead vegetation cover (shading aquatic areas) degraded fish habitat by increasing flow rate and water temperatures and exposing species to predation. The construction-related removal of habitat also adversely impacted juvenile and larval fish that depend on edge and shallow habitat for survival.

Displacement of Water Bodies with Fill Materials

In many reaches within the HSDRRS, the base of the earthen levee was expanded into open water to meet flood height requirements for the existing levee. This expansion permanently filled open water habitat areas with dirt and rock, and the resulting alterations in water quality from sediment loading often adversely impacted fisheries by lowering DO and increasing water temperature. However, it is assumed that resident motile organisms attempted to avoid construction activities and sought refuge in adjacent and suitable habitat.

Mitigation for impacts on open water habitats and the use of WVA models to evaluate such impacts will follow guidelines developed cooperatively between CEMVN, NMFS, and USFWS (see appendix S). Those guidelines are undergoing further refinement. The USACE anticipates completion of the guidelines prior to the release of any supplement(s) to the CED, and the final version of these guidelines will be included, as appropriate, in forthcoming NEPA documents. In general, mitigation for impacts on open water habitats would typically be limited to any fill that would permanently affect open water habitats classified as EFH or containing SAV; any excavation impact on open water habitats containing SAV, or designated as EFH where excavation would create permanent anoxic conditions in the affected area; any fill or excavation impact on open water habitats containing SAV species that include seagrasses; or any fill or excavation in open water habitat that is designated as oyster seed grounds by LDWF. However, mitigation for impacts on open water habitats would not typically be required for dredging in open water areas where no SAV is present (even if the affected area is designated as EFH), for filling of an open water area such that the area would not be converted to non-aquatic habitat, or where the impact on open water habitats would be less than 1 acre within a single open water area.

Dredging Activities and Materials Stockpiling

Dredging activity suspends and redistributes water bottom sediments and adversely impacted fisheries and aquatic organisms by increasing turbidity in the water column. Additional adverse impacts on fisheries resources associated with sedimentation and siltation from dredging activities include clogged gills, reduced growth rates, and disruption of egg and larval development (USEPA 2003). Likewise, the resuspended water bottom sediments, which are composed primarily of organic particles attached to inorganic sediments, feces, dead algae, and decaying plant matter, often dominate oxygen dynamics and cause oxygen depletion (LDEQ 2000). This depletion adversely impacts fish and aquatic organisms by decreasing available DO and has been correlated with winter and summer fish-kills.

Dredging activities also cause scouring in some areas of the waterway and deposition of the sediments over other areas. The deposition of sediments blankets the water bottom, where some sessile benthic organisms were likely destroyed due to their limited ability to relocate from the area. These benthic organisms often served as prey species and contributed to the fisheries food web. Fisheries and food web dynamics were adversely impacted due to the reduced availability of benthic organisms.

Hydro-modification

Temporary and permanent impacts from hydrologic modification occurred where the HSDRRS actions modified the flow of water through the levees, realigned the course of channels, and resulted in permanently dredged channels for the construction of the HSDRRS. The draining or filling of canals or ditches often resulted in the stranding and mortality of fish and other aquatic organisms. This also occurred during cofferdam unwatering and watering throughout the HSDRRS construction area. It is likely that resident motile organisms avoided construction activities and sought refuge in adjacent and suitable habitat. Some sessile benthic organisms were likely destroyed due to their limited ability to relocate from the area.

Channel restrictions from new gates and floodwalls alter channel velocities and have the ability to impede fishery movement. In most cases, channel restrictions from gate construction are similar to the original design, and the changes primarily involved constructing taller structures without any permanent changes to channel cross-sections. The Borgne barrier and Seabrook gate complex altered flows and channel velocities both temporarily during construction with channel closures and permanently through a reduced channel cross-section. However, hydrodynamic modeling has demonstrated that the long-term impacts on channel flows and channel velocities

are minor and are primarily limited to low-frequency events such as the combination of a strong spring tide with a winter frontal passage (USACE 2010d). These low-velocity events can alter fish movement, but would be limited to relatively short periods of time and would not permanently alter fish movement through these channels.

Specific Impacts of the HSDRRS

Impacts on fisheries and fish habitats resulting from specific construction activities; associated dredge, fill, and material stockpiling activities; water body displacement; and/or hydrologic modifications of waterways and ecosystems within the HSDRRS project area are detailed below. The HSDRRS project impacts on fisheries and fish habitat are further discussed within each of the nine separate sub-basins located on the east (LPV) and west (WBV) banks of the Mississippi River within the HSDRRS project area.

Acreage assessments utilized in the impact discussions are based on the Final IER documents and their corresponding Decision Records. The compensatory mitigation AAHUs, however, are based on a final CAR provided by USFWS, where applicable. The USACE agreed to mitigate based on these final CARs. Impacts on fisheries, fish habitat utilization, and fish habitat were likely to occur with the loss of open water aquatic, fresh marsh, brackish, and swamp habitats. A summary of these habitats and their associated loss of AAHUs are provided for each of the nine sub-basins. However, HSDRRS construction is ongoing, and final compensatory mitigation values are dynamic and may change based on final construction impacts. The final compensatory mitigation values will be addressed in the HSDRRS Mitigation IERs. However, the most current mitigation requirements can be found in appendix N.

A number of mitigation measures were implemented by the USACE to avoid or minimize impacts on fisheries to the maximum extent practicable. However, some work presented in the IERs was not performed for the HSDRRS 2011, and may or may not be performed in the HSDRRS 2057 effort; as such, these final compensatory mitigation values could change, and the final compensatory mitigation values will be addressed in the HSDRRS Mitigation IERs. The most current values can be found in appendix N. Mitigation efforts implemented by the USACE to minimize fisheries impacts are discussed in section 5.0.

St. Charles Sub-basin (IER #1 and IER Supplemental #1)

A minor permanent impact occurred on fisheries. Temporary indirect effects on fisheries occurred from levee construction, which impacted approximately 292 acres of wetlands (swamp on the floodside and protected side for the HSDRRS structures) and 8 acres of open water bodies. The removal of fish habitat associated with drainage structure construction was detrimental to juvenile and larval fish that depend on edge and shallow habitat for survival. Impacts likely resulted in increased turbidity in wetlands and open water surrounding the project area. Suspended materials result in clogging of fish gills, lower growth rates, and impacts on the development of egg and larva. However, resident motile organisms would have attempted to avoid construction activities and sought refuge in adjacent and suitable habitat. Likewise, impacts from the drainage structure construction activity were minimized using stormwater BMPs developed by construction contractors.

Although wetlands loss from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat, impacts on fisheries and fish habitat as a result of the St. Charles sub-basin projects were considered temporary and minor.

With the drainage structures in place, edge habitat was enhanced and provided some shelter during low flow periods for juvenile and larval fish, nekton, and other aquatic organisms. During construction to modify the existing drainage structure at Almedia or Walker, flow was likely limited to other drainage structures not under construction. Preventing flow through the

Almedia or Walker drainage structures caused minor impacts on fish passage from the flood side to the protected side. The cofferdam also prevented passage during periods of closure.

Jefferson East Bank Sub-basin (IERs #2, #3, #27, and IER Supplemental #3.a)

A moderate permanent adverse impact occurred on fisheries. Construction of the new floodwall along the HSDRRS reaches (through wetlands, along the Parish Line Canal, and a small drainage ditch) impacted 34 acres of wetlands habitat and likely destroyed the immobile and less mobile species in the filled areas of wetlands, Parish Line Canal, and the drainage ditch (IER Supplemental #2). Portions of these habitats were considered high-quality and were also designated EFH, and provide significant nursery/foraging/cover habitat for fish species. Most mobile species within the wetlands, canal, and ditch likely avoided the areas impacted and moved from areas being permanently filled to adjacent wetlands and canal habitat. The existing aquatic and wetlands habitat that was destroyed was replaced by mostly hard rock surfaces, suitable for colonization by periphyton and other sessile organisms. This new habitat likely provided protective cover for various species of shellfish and finfish, thus serving as a more productive aquatic community.

The addition of wave attenuation berms and rock foreshore protection within lakefront levee reaches permanently covered approximately 53 acres of lake bottom habitat along the shoreline west of the Causeway Bridge and 8 acres east of the Causeway Bridge (IER Supplemental #3.a). An additional 211 acres were temporarily impacted from the access dredging and material stockpiling. A total of 3.5 acres of lake bottom habitat was lost to hard fill in support of the pump station breakwaters (FWCAR-IER Supplemental #3A).

Brackish marshes are important as nurseries for fish and shellfish. Brackish marshes provide important edge habitat due to the interspersed ponds and water channels that make up its topography and that are sensitive to saltwater intrusion and fragmentation. Implementation of the HSDRRS likely resulted in adverse impacts on fisheries and many marine and aquatic organisms that rely on brackish marshes and their biological processes for a portion, or the entirety, of their life cycle.

Access dredging and materials stockpiling disturbed sessile and filter-feeding organisms and benthic invertebrates that depend on a firm substrate for attachment and colonization. Benefits of dredging occur over time, as the removal of material deepens the water and increases the flow rate in areas that may currently be experiencing low DO. Increased flow rates encouraged a diurnal pulse of bait fish along the shorelines of Lake Pontchartrain and its associated tributaries.

Most of the impacts on fisheries from the hard fill occurred on the bottom-dwelling fishes and sessile invertebrates that utilize the edge habitat for foraging and/or spawning. The hard fill resulted in a beneficial impact on fisheries by providing protection to larval and juvenile fishes as a nursery habitat and/or by providing additional edge habitat for foraging by larger fish. The hard substrate also provided habitat for sessile filter feeders that over time will potentially enhance the water quality nearshore. In addition, an increase in rocky material benefited local assemblages of nekton that are important to sustaining local fisheries, especially blue crab.

No direct or indirect impacts were expected from the remediation of the canal walls within the Jefferson East Bank sub-basin (IER #27). BMPs were implemented to prevent sediment and pollutants from entering waterways. As a result of the Jefferson East Bank sub-basin projects, impacts on fisheries and fish habitat were considered temporary and minor.

Orleans East Bank Sub-basin (IERs #4, #5, and #27)

Much of the construction activity within the Orleans East Bank sub-basin occurred, or will occur, in upland areas; therefore, only minor permanent impacts on fish habitat were anticipated. Any impact on fisheries due to construction-related increased turbidity associated with stormwater runoff from staging areas was indirect and temporary (IER #4).

Temporary impacts, such as noise, nutrient runoff, and increased turbidity, on fisheries likely occurred due to construction-related activities (including the use of barges in the canals). It was anticipated that fisheries returned to pre-construction abundance once construction was completed. No direct and indirect impacts were expected from the remediation of the canal walls (IER #27 and FWSCAR-IER #27). BMPs were implemented to prevent sediment and pollutants from entering waterways.

Temporary impacts on water turbidity, DO, and BOD during construction and storm events temporarily displaced fish species. Siltation and suspended sediment in waters adjacent to the project area likely affected fish and other organisms by clogging gills and reducing growth rates, and adversely affected the development of eggs and larvae. Impacts on water quality from increased turbidity or sediment loading affected fish populations by lowering DO and raising water temperatures.

The rebuilding of earthen levees, gates, and floodwall replacement was expected to result in no significant impact on valuable fish habitat (FWCAR-IER #4). Open water/mud bottom habitat in Lake Pontchartrain likely was impacted by the construction of temporary pump station structures at the mouth of the canals (IER #5) and would be again during construction of permanent pump stations. However, those habitats no longer support significant fish use (FWCAR-IER #5). Impacts on fisheries and fish habitat as a result of the Orleans East Bank sub-basin projects, therefore, were considered temporary and negligible.

New Orleans East Sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain, #11 Tier 2 Borgne, IER Supplemental #6 and IER Supplemental #7)

Construction activities that raised the LPV-105 floodwalls, raised the LPV-106 levee, and constructed LPV-107 floodgates resulted in only minor temporary impacts on open water habitats and a small loss of wetlands, having minor permanent impacts on fisheries. The construction of floodwalls, floodgates, and levee improvements was anticipated to result in no direct impacts on fish populations or fish habitats in Lake Pontchartrain. Implementation of a SWPPP minimized temporary indirect impacts on fish populations and fish habitats resulting from potential soil erosion and consequent degradation of water quality. The USFWS similarly concluded that the IER #6 activities did not result in significant impacts on fisheries or wildlife (FWCAR-IER #6).

The raising and relocation of pump stations within LPV-109 and LPV-111, along with the provisions for temporary pumps during construction, resulted in impacts on wetlands and waters of the U.S. These impacts indirectly impacted fisheries by further reducing the availability of habitat for fish prey items, potential fish spawning sites, and areas for juvenile fish to hide from predators (IER Supplemental #7 2009).

Approximately 371 acres of wetlands, which provided habitat for fish prey items and areas for juvenile fish to hide from predators, were permanently lost in the sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain, and IER #11 Tier 2 Borgne). Permanent and temporary open water impacts occurred from the construction of the Seabrook complex gate. Estuarine open water and benthic habitats were directly impacted by the footprint of the sector gate, two lift gates, and associated floodwall tie-ins. During construction, approximately 2.5 acres of open water were temporarily

impacted by the cofferdam structure, construction easements, and staging areas. Significant temporary impacts, including decreased larval recruitment and altered DO levels that had the potential to result in fish-kills, were likely from the complete closure of the IHNC. Negligible, temporary impacts resulted from construction noise and increased turbidity (IER #11 Tier 2 Pontchartrain). NMFS recommended that the south scour hole be filled and the cofferdam be constructed only during slack tide when waters are moving from the lake into the IHNC in order to avoid movement of sediments north into Lake Pontchartrain. The scour hole was filled, and instead of only constructing the cofferdam during slack tides, a rock dike was constructed between the cofferdam and Lake Pontchartrain to prevent the movement of sediments into the lake during construction. Following the placement of the rock dike, the braced cofferdam was constructed. Approximately 6.9 additional acres of low-quality open water and benthic habitat, including deep water habitat used by large predatory species, were permanently lost as a result of the new flood control structures at Seabrook. The USACE's ERDC predicted that bottom DO levels would fall below the 4.0 mg/l standard with the HSDRRS (USACE 2008n).

Prior to the Bayou LaLoutre closure structure across the MRGO as part of the Deep-draft Deauthorization Project, the IHNC/GIWW served as a major conduit between the Gulf of Mexico and Lake Pontchartrain for many aquatic resource species. Significant alterations to this conduit changed transport/migration patterns and likely caused positive and negative impacts on multiple benthic and pelagic species, including rangia clam (*Rangia cuneata*), fish, shrimp, and crabs. Mobile organisms (e.g., shrimp, crab, and fish) have a longer travel time to reach salinities conducive to habitats where suitable prey items are found. Migratory species experienced a smoother transition into and out of the lake, using salinity gradients and tidal flow. Impediments to migration of aquatic species in IHNC, however, could have resulted in elevated predation, entrapment, and starvation. Decreases in lower trophic-level aquatic species could have negatively impacted upper trophic-level species in Lake Pontchartrain that rely on them as a food source.

The New Orleans East sub-basin also included the construction of approximately 2 miles of a new floodwall/gated system extending from the Michoud Canal floodwall north of the GIWW to the HSDRRS levee on the west side of the deauthorized MRGO, connecting the New Orleans East sub-basin to the Chalmette Loop sub-basin. The floodwall/gated system crosses the GIWW, Bayou Bienvenue, the deauthorized MRGO, and the Golden Triangle marsh. Direct impacts on fishery resources occurred during the removal of estuarine substrate (under open water), estuarine open water, and marsh (fresh/intermediate and salt marsh) within the footprint of the floodwall and other structures (USACE 2010k). Placement of the floodwall impacted fisheries by causing a localized reduction in and access to marsh edge and inner marsh habitat, since conduits between the protected and flood side of the barrier now occurred only via Bayou Bienvenue and the GIWW (IER #11 Tier 2 Borgne). Screened culverts were used in the Bayou Bienvenue cofferdam. No fish-kills were reported in this area.

A reduction in access to these marsh habitats resulted in direct impacts on fisheries due to lower-quality habitat available for organisms; marsh edge habitat is a critical link in the recruitment of fishery species. Approximately two to three spawning seasons of larval and juvenile migration along the GIWW and MRGO (via passage beginning north of the Bayou Bienvenue closure) into Lake Pontchartrain through the IHNC was likely impacted. A probable positive impact on recreational fishing, depending on water quality, resulted from the concentration of numerous prey items at the cofferdam and the attraction of larger fish and predators to the area. However, additional predator species concentrating in the area could have an adverse impact on prey species.

Construction of the Borgne barrier across the Golden Triangle marsh and associated waterways adversely impacted fisheries by increasing fragmentation of the emergent marsh habitat and altering natural hydrologic sheet flow, sedimentation processes, and recruitment and migration of

important estuarine aquatic organisms needed to sustain the fisheries food web. Incidental mortality of some fishes and benthic organisms likely occurred from burial during dredging and placement of disposal material. Most fishes were expected to relocate until construction activities were completed. To minimize impacts on fisheries, four 48-inch culverts within the Bayou Bienvenue cofferdam were installed during construction of the gate structure to allow for hydrologic exchange and potential fish passage. The USFWS determined that the floodwall and other structures directly impacted fresh/intermediate marsh and brackish marsh (FWCAR-IER #11), all of which provides habitat for juvenile fish and their prey.

Numerous anthropogenic disturbances during the last 50 years have resulted in changes in fish assemblages in Lake Pontchartrain (O'Connell et al. 2004). However, fisheries in Lake Pontchartrain have been directly affected by habitat shifts associated with salinity changes from the construction of the MRGO. In an extensive review of MRGO impacts, the Final Report – Environmental Resources Documentation Mississippi River – Gulf Outlet Re-Evaluation Study Southeast Louisiana described that 10 freshwater fish species of the 22 species previously documented in the Biloxi marsh complex near the MRGO disappeared after the completion of the MRGO construction. This was attributed to the salinity shift inland that occurred as a result of the MRGO (LPBF 2006). A three-dimensional hydrodynamic/salinity model of the Lake Pontchartrain system was developed for the purpose of analyzing the impacts of Borgne barrier designs on current velocities and salinity levels in the Lake Pontchartrain system. This ERDC report predicted that the salinity of ambient waters would be very minor, with bottom salinity decreases ranging from 0.5 to 2 PPT with the HSDRRS structures in place (USACE 2010d). The greatest decrease in salinity in Lake Pontchartrain was predicted from the MRGO closure at Bayou La Loutre associated with the MRGO Deep-draft Deauthorization project, where salinity reduction as high as 10 PPT was predicted immediately north of the closure structure (USACE 2010d). This model was confirmed, as a decrease in salinity was observed in the vicinity of the MRGO closure at Bayou La Loutre, and fish-kills were reported south of the structure. However, to date, no fish-kills have been reported around the IHNC. Monitoring of DO concentrations and salinity are ongoing, and the results will be used to determine the impacts of the structures on changes in water quality. Monitoring results to date are located in appendix G, and the final study results are anticipated to be completed by 2013. Based on modeling results, it is anticipated that the closure of the MRGO from the Deep-draft Deauthorization project, and the second closure of the MRGO from the Borgne barrier have reduced salinities in the MRGO/IHNC and Lake Pontchartrain, and the reduction in salinities would provide a long-term benefit to fish species which utilize freshwater and low salinity wetlands as nursery and foraging habitats in the Lake Pontchartrain basin.

Reductions in fish passage are a concern with many types of USACE structures, including gated structures. Hydrologic modeling performed by ERDC predicted that surface velocities in the MRGO and the GIWW were expected to have only minor increases, and velocity increases were limited to the immediate vicinity of the structures (USACE 2010d and USACE 2008m). According to the NMFS guidance document, *Fisheries Friendly Design and Operation Consideration for Hurricane and Flood Protection Water Control Structures*, velocities greater than 2.6 ft/s can inhibit fish passage while causing greater adverse impacts on less mobile species. The USFWS further recommended that these NMFS criteria (FWCAR-IER #11) be considered during the HSDRRS project designs. The hydrologic modeling did predict that the maximum velocity at the Bayou Bienvenue structure would exceed the 2.6 ft/s threshold for fish movement, but these maximum velocities were limited to low frequency events when there is a combination of a strong spring tide and a frontal passage (USACE 2010d). An analysis of surface and bottom channel velocities relative to swimming performance of red drum, spotted seatrout, and brown shrimp (used as surrogates for various size fish species) was conducted for the structures at Seabrook, Bayou Bienvenue, the MRGO, and the GIWW. Estimates of swimming capacities for red drum and spotted seatrout greater than 50 millimeters in length suggest that the maximum channel velocities after construction will be manageable. However,

although there are only minor changes in channel velocities with the structures in place, small fish less than 40 millimeters in size were likely exposed to velocities greater than their swimming capacity before the construction of the Seabrook gate complex and Borgne barrier, and continue to be exposed to those higher velocities after construction (USACE 2008u).

Further, to determine the potential impacts of these new structures on fish passage, a particle transport model was developed that applied larval fish behaviors to particles and evaluated the movement of these particles through the MRGO, and the structures at Bayou Bienvenue, the GIWW, and the IHNC at Seabrook (USACE 2010l). Although there are some limitations to modeling fish larval behavior in this way, it provides a reasonable estimate of how larval fish recruitment (i.e., where the larvae would reach an optimal environmental position to grow into adults) would be impacted by the change in velocities from these structures. The model was run for two separate 4-week-long time periods (September 2007 and March 2008). Various structure implementation scenarios were also modeled, from just the closure of the MRGO due to the MRGO Deep-draft Deauthorization project's structure at Bayou LaLoutre, through the completion of the entire Borgne barrier and Seabrook gate complex. Finally, the model assessed recruitment under four different initial positions of the representative larval fish particles (USACE 2010l).

The most substantial change in water velocities, surface elevation, and circulation at all modeled locations occurred from the closure of the MRGO at Bayou LaLoutre. Changes continue to occur with the implementation of the structures in the IHNC at Seabrook, the GIWW, Bayou Bienvenue, and the MRGO, but these combined changes are less than those created by the MRGO closure at Bayou LaLoutre. The model found that larval fish transport within the IHNC, MRGO, GIWW, and Chef Menteur areas are most greatly affected by the hydrodynamics of the system, where larval fish particles released during stronger events were recruited into Lake Pontchartrain at a greater rate than those particles released during a less intense event. The model also indicated that after the completion of the Seabrook gate complex and Borgne barrier, that larval recruitment, as represented by larval fish particles, was reduced by approximately 10 to 15 percent compared to conditions before their construction (i.e., with the MRGO closure at Bayou La Loutre) (USACE 2010l). Based on the model results, the completion of construction of the Seabrook gate complex and Borgne barrier would have a minor impact on larval fish recruitment in Lake Pontchartrain.

Permanent wetlands loss and hydro-modifications, as well as temporary water quality impacts from HSDRRS construction activities, affected local and regional fisheries (and prey) species through the direct loss of fish habitat and modification of fish navigation. These impacts on fisheries and fish habitat as a result of the New Orleans East sub-basin projects were considered moderate.

Chalmette Loop Sub-basin (IERs #8, #9, and #10)

Construction of a new Bayou Dupre flood control structure with steel sector gates and floodwall tie-ins built on the flood side of and adjacent to the existing structure resulted in minor permanent impacts on fish habitat within the Chalmette Loop sub-basin. Up to 2 acres of aquatic habitat in Bayou Dupre was disturbed during construction, and approximately 0.3 acre was permanently filled post-construction. During construction, reduced tidal exchange likely occurred on over 40,000 acres of marsh and open water habitat (FWCAR-IER #8). Alterations in water quality from sediment loading associated with construction adversely impacted fisheries by lowering DO and increasing water temperature. Space was left between the cofferdam and the bank to allow some flow into the Central Wetlands Area. Therefore, limited potential for entrapment of fish was anticipated (IER #8).

Indirect impacts on fisheries from construction in upland areas (19-acre HSDRRS construction corridor) and in the Caernarvon Canal likely resulted from increases in turbidity and sedimentation in local waterways. Up to 5.2 acres of wetlands and 0.3 acre of aquatic habitat were estimated to have been lost. This impact was minimized by implementation of BMPs (IER #9).

Additional construction within the Chalmette Loop sub-basin included a T-wall on top of existing levee reaches (LPV-145, 146, and 148) and floodgates (LPV-147) in the Chalmette Loop levee system. These construction projects were estimated to have resulted in the loss of approximately 430 acres of wetlands habitat (IER #10).

Wetlands loss and temporary hydrologic alteration from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat and temporary restriction to forage and nursery areas. Therefore, temporary impacts on fisheries and fish habitat were major, but long-term impacts were minor as a result of the Chalmette Loop sub-basin projects.

Belle Chasse Sub-basin (IER #13)

Temporary and indirect impacts on fisheries in the Belle Chasse sub-basin likely occurred as a result of the construction-related activities. However, the direct loss of 39 acres of cypress-tupelo swamp habitat south of the Hero Canal was also estimated to occur. This habitat functions as part of the Barataria Bay Estuary and is important to the sustainability of local and regional fisheries by providing prey species for many commercial fisheries. The quality of these wetlands areas and associated fish habitat, however, was affected by past development and flood control activities (IER #13), and only minor permanent impacts on fisheries occurred.

A stoplog closure was built to allow for continuous passage of vessels through the Hero Canal and will only be utilized when floodwaters recede to near equilibrium on both sides of the gate. The construction of the stoplog gate resulted in temporary direct impacts on fisheries that utilize the canal for migration to and from the Barataria Bay Estuary. Under normal conditions, the associated pump station will not be operational, gates will remain open, and water flow through the channels will remain stable, thus resulting in negligible impacts on fisheries. As part of the construction, dredged material was utilized as borrow. Dredging increased suspended solids in the water column and adversely impacted fisheries. A temporary impact on water quality occurred, and thus an impact on fish habitat was anticipated, from construction activities and included increased turbidity, decreased DO, slight increases in temperature, and increased BOD (FWCAR-IER #13).

Although wetlands loss from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat, impacts on fisheries and fish habitat as a result of the Belle Chasse sub-basin projects were considered temporary and minor.

Gretna-Algiers Sub-basin (IER #12 and IER Supplemental #12)

Construction activities within the Gretna-Algiers sub-basin had a permanent minor impact on fisheries, and included altering the original system alignment and constructing a streamlined surge barrier, floodwall, and levee alignment. The T-wall construction directly impacted estuarine habitat within the Bayou aux Carpes CWA Section 404(c) area. This habitat is important to sustaining fisheries associated with the Bayou Barataria Estuary. The loss of this critical aquatic habitat impacted fisheries population and recovery. Bayou aux Carpes CWA Section 404(c) area foreshore protection benefits fisheries through the creation of a complex habitat for fish and shellfish species. Rock foreshore protection along the shoreline improved

edge habitat for refuge while reducing turbulence and water flow and enhancing recruitment opportunity for sessile aquatic organisms.

Dredging and materials stockpiling activities impacted fisheries and aquatic life due to the permanent loss of aquatic habitat that fish use for forage and refuge. Motile aquatic organisms, however, were likely to seek refuge elsewhere by relocating to adjacent undisturbed waters during construction. Additional recruitment of fisheries was hindered by construction, as many species likely avoided the project construction area. Benthic organisms were impacted due to their inability to vacate the construction area. Indirect effects on aquatic species occurred from increased turbidity, decreased DO, vibrations, and subsurface noise.

The WCC construction was estimated to temporarily disrupt 4 acres of open water fish habitat during construction (IER #12). The gate structures will remain open with sustained water flow during normal conditions. However, during major storm events the gates will be closed, directly impacting fish movement through the GIWW and trapping fish on either side of the floodgate.

Earthen levee construction and Bayou Road realignment resulted in temporary impacts on fisheries within disposal areas due to the discharge of dredged material into water bottoms. Fish species likely vacated the construction area during these activities. Discharge of dredged material and resulting suspended sediments indirectly affected phytoplankton productivity in the nearby waters; however, the overall effect on primary productivity was negligible, and indirect impacts were temporary.

Wetlands loss, hydro-modifications, and water quality impacts from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat, modification of fish navigation, and overall degraded habitat water quality. These impacts on fisheries and fish habitat as a result of the Gretna-Algiers sub-basin projects were moderate, and although project augmentation features have not been designed or constructed, they would have beneficial impacts if implemented in the future.

Harvey-Westwego Sub-basin (IER #14 and IER Supplemental #14.a)

Construction activities within the Harvey-Westwego sub-basin included the elevation of levees, divided into five main reaches (WBV-14c, WBV-14b, WBV-14f, WBV-14d, and WBV-14e), where some reaches included floodwalls for pump station protection (IER #14). Negligible permanent direct and indirect construction-related impacts on fisheries and aquatic habitat were anticipated to occur at discrete locations along the levee construction. Indirect effects on adjacent waters during construction included increased local turbidity, decreased DO levels, vibrations, and subsurface noise.

Since the construction activities occurred on the protected side of the existing levee, no impacts on fish habitat of the Bayou aux Carpes CWA Section 404(c) wetlands (flood side) occurred. Fisheries and aquatic habitat within the existing canal, however, were adversely impacted from the loss of habitat in the canal segments being filled to accommodate the levee expansion. The USFWS determined that the levee construction associated with the WVB 14b levee reach directly impacted 29.75 acres of cypress-tupelo swamp (FWCAR-IER #14).

Modifications of levee reaches WBV-14c and the WBV-37 and WBV-43 Ames and Mt. Kennedy Pump Stations resulted in further impacts on fish habitats (IER Supplemental #14). An additional 42 acres of cypress-tupelo swamp was cleared, grubbed, and filled as part of the levee flood-side shift and enlargement. The area consists of wetlands adjacent to Bayou Segnette and is considered medium- to high-quality swamp.

The existing borrow pits along the flood side of the existing levee (WVB-14b) were partially or permanently filled to support the levee enlargement. The borrow pits within this reach were reduced in size, decreasing available habitat for fish and other aquatic organisms. However, the remaining borrow pits provide viable fisheries and aquatic habitat. Motile organisms were expected to avoid construction activities and seek refuge in adjacent undisturbed waters. Some benthic organisms were likely impacted due to their inability to vacate the construction area. Indirect effects included increased local turbidity, decreased dissolved oxygen levels, vibrations, and subsurface noise. Overall, impacts of the borrow pits on fisheries and aquatic habitat from filling were not significant.

Although wetlands loss from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat, impacts on fisheries and fish habitat as a result of the Harvey-Westwego sub-basin projects were considered temporary and minor.

Lake Cataouatche Sub-basin (IERs #15, #16, #17, and IER Supplemental #16.a)

During construction within the Lake Cataouatche sub-basin, the base of the earthen levee was expanded into the open water habitat of the Outer Cataouatche Canal (IERs #15 and #16). This expansion permanently filled open water habitat areas with dirt and rock. Direct and permanent minor effects on fish habitat likely resulted from the placement of earthen material into aquatic habitat in the Outer Cataouatche Canal. The USFWS determined that the western levee construction crossing the Outer Cataouatche Canal directly impacted 134.1 acres of fresh marsh (FWCAR-IER #16).

These construction activities were anticipated to result in alterations in water quality from sediment loading and to adversely impact fisheries by lowering DO and increasing water temperature. Similarly, the benthos of the Outer Cataouatche Canal, which is dominated by invertebrates that tolerate poor water quality (e.g., midges and oligochaetes) (USACE 1996), were likely disturbed during construction activities; however, the benthos likely recovered since they are adapted to a poor water quality environment. The rock utilized for earthen levee expansion and shoreline protection and stabilization may, over time, benefit fisheries.

Dredging of the navigation channel for Bayou Verret and the Bayou Verret bypass channel excavation was anticipated to cause temporary localized increases in turbidity from the disruption of sediments during construction. Mobile species of fish were anticipated to find refuge in nearby habitat, but sessile and dormant species were likely destroyed during construction. Fish and aquatic species of wildlife likely benefited from the excavation of approximately 8 acres of new drainage and bypass canals.

Indirect impacts on fisheries were anticipated from the construction of the western closure of the Outer Cataouatche Canal, which resulted in the isolation of the western portion of the Outer Cataouatche Canal from through-flow. The isolation was expected to indirectly alter the fish community sustainability within the approximately 60-acre partially enclosed area. Fish habitat in the eastern portion of the Outer Cataouatche Canal was likely altered from the diminished flow in the canal, even though the canal has remained connected through Bayou Verret and the Bayou Verret bypass channel (IER #16).

Further modifications that impacted fishery habitat included the construction of utility relocations, replacement of the US 90 pump station, addition of bank stabilization to some areas, and the construction of a ramp at LA 18 instead of a floodgate. An additional 16.5 acres of open water habitat were estimated to be impacted from the construction modifications (IER Supplemental #16.a). The USFWS determined that these construction modifications of the Outer Cataouatche Canal directly impacted an additional 14.1 acres of fresh marsh (FWCAR-IER Supplemental #16a).

The construction of the new floodwall alignment north of Lapalco Boulevard likely disturbed fish and wildlife within approximately 4 acres of aquatic habitat, and permanently displaced all fish and wildlife within the 19-acre dredge island and the surrounding vegetated shallows. The dredge island and surrounding shallows were transformed from natural habitat by removing all of the vegetation and constructing the new alignment. In addition, dredging of the navigation channel and excavation and removal of surficial sediments caused temporary localized increases in turbidity from the disruption of sediments during construction. The USFWS determined that the new alignment north of Lapalco Boulevard directly impacted an additional 19 acres of swamp habitat (FWCAR-IER #17).

Wetlands loss, hydro-modifications, and water quality impacts from construction activities affected local and regional fisheries (and prey) species through the direct loss of fish habitat, modification of fish navigation, and overall degraded habitat water quality. These impacts on fisheries and fish habitat as a result of the Lake Cataouatche sub-basin projects were minor.

Impacts from Borrow In and Outside the HSDRRS Sub-basin Boundaries

The only borrow site location identified with the potential for fisheries impacts was the Bonnet Carré North area (IER #18). Fish observed in the Bonnet Carré's existing borrow ponds included mosquitofish, killifish, shortnose and spotted gar, redbfin shad, bass, bluegill, and catfish. The Bonnet Carré North borrow site was utilized for the HSDRRS construction.

Most borrow sites that have been evaluated in an IER have not been used, and due to numerous reasons, including local ordinances, landowner requirements, and lack of need, these borrow sites will likely not be used for HSDRRS construction. For the purposes of impacts discussion, it was anticipated that borrow ponds at borrow sites were not immediately filled with water during borrow removal (i.e., dewatering activities occurred during borrow site excavation), and the ponds located near other aquatic areas, such as at Bonnet Carré, may have filled with adjacent waters to create additional habitat for fisheries. Impacts on fishes in ponds located at previously used borrow sites (see table 2-7) occurred during additional borrow removal. Motile organisms, however, avoided construction activities (borrow removal) and sought refuge in adjacent undisturbed waters. Some benthic organisms were likely impacted due to their inability to vacate the construction area. Indirect effects included increased local turbidity, decreased dissolved oxygen levels, vibrations, and subsurface noise.

However, most borrow was removed from upland areas where no aquatic habitat was present. Excavation of jurisdictional wetlands was avoided in the borrow process. At most borrow sites, the excavation was limited strictly to upland areas and had no impacts on fisheries. Overall, no impacts on fisheries and aquatic habitat occurred from excavating material from borrow sites, including those sites such as Bonnet Carré that have nearby aquatic features, and in some cases, habitat for fish was created following borrow material excavation.

4.2.5.2.2 HSDRRS 2057 Impacts

Short-term construction-related fisheries impacts from the future levee lifts would include damage to adjacent wetlands vegetation utilized as fish habitat, disturbance to sediments, and increased turbidity and sedimentation in the adjacent fish habitat and drainage canals. After construction, the habitats would stabilize, allowing for suspended sediments to settle and vegetation to recolonize the area. Construction-related impacts would also affect other habitats utilized by fisheries, including lake bottoms, canal bottoms, drainage waterways, and open water. Direct impacts from dredging include increased turbidity during dredging, disruption of water bottoms from access channels and material stockpiles, and destruction of SAV.

The removal of fish habitat associated with an expanded ROW that could be needed for levee lifts would be detrimental to juvenile and larval fish that depend on edge and shallow habitat for survival. Impacts would likely result from increased turbidity in wetlands and open water surrounding the project area. Suspended materials would result in clogging of fish gills, lower growth rates, and impacts on egg and larval development. However, it is assumed that resident motile organisms would attempt to avoid construction activities and seek refuge in adjacent and suitable habitat. Likewise, impacts on fisheries from expanded ROW construction activities would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) as described in the project's SWPPP.

Potential future impacts on fisheries and fish habitat associated with the specific levee lift projects are similar to the complete HSDRRS construction impacts and, overall, would be minor.

Although foreshore protection was proposed for IERs #6 and #7, this was not completed under the HSDRRS 2011 work. It is anticipated that it may be performed in the future. Construction activities associated with raising foreshore protection would temporarily impact approximately 61.1 acres of Lake Pontchartrain lake bottom by causing a short-term loss of forage habitat for finfish and shrimp. Approximately 6.9 acres of Lake Pontchartrain would be permanently filled, causing a loss of forage habitat for finfish (IER #6). Dredging activities associated with raising the existing foreshore protection would temporarily impact 118.1 acres of lake bottom and permanently fill 7.2 acres of shallow water habitat. These activities would cause a loss of forage habitat for finfish. However, permanently submerged portions of the riprap that would be placed would result in a beneficial impact by providing habitat for small forage fishes such as killifish and gobies.

Although some additional wetlands loss from construction activities may affect local and regional fisheries (and prey) species through the direct loss of fish habitat and temporary water quality degradation, impacts on fisheries and fish habitat would be considered temporary and minor as a result of the future HSDRRS projects. Impacts from the future excavation of borrow material on fisheries and aquatic habitat would be similar to those described for the HSDRRS 2011 work, and would be negligible.

4.2.5.3 Cumulative Impacts

4.2.5.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

HSDRRS projects and their associated excavation of borrow areas would contribute directly and indirectly to cumulative impacts on fisheries and fish habitat in the project area. Direct fish habitat loss occurred as a result of filling waterways and wetlands (open water aquatic, and 1,502.49 acres of fresh marsh, brackish, and swamp habitats) for ROW for the HSDRRS 2011 projects. Additional ROW and expanded footprints would likely be necessary to achieve the HSDRRS 2057 action, so additional, permanent impacts on fish habitat (open water aquatic, fresh marsh, brackish marsh, and swamp habitats) would occur. However, long-term impacts would be minor, as these expanded footprints would primarily impact borrow pits and low-quality fringing wetlands along the base of levees. Cumulatively, valuable aquatic shelter and foraging habitat for fish and prey species have been and will be adversely impacted due to the direct loss of fish habitats resulting from the HSDRRS.

The direct cumulative HSDRRS impacts on fisheries and fish habitat are primarily associated with the actual construction activities, the associated dredge, fill, and material stockpiling activities, water body displacement, and hydrologic modifications of waterways and ecosystems. The indirect cumulative HSDRRS impacts on fisheries and their habitats could include adverse effects on fish migratory movements; active/passive transport of fish eggs and larvae; nursery habitat and recruitment of fish larvae and juveniles; water characteristics and organism access to abiotic water quality habitats (e.g., temperature, salinity, turbidity, and DO); organism access to

biotic water quality habitats (e.g., protection from predators and food availability); and hydrology and water velocity.

Indirect cumulative impacts on fisheries associated with the closures on MRGO, the Borgne barrier, and reduced cross-section area at Seabrook could likely result from changes in hydrology, salinity, DO, and other biotic and abiotic water quality characteristics. The CEMVN has committed to conducting monitoring to obtain observed rather than predicted DO and salinity data to determine the long-term cumulative impacts of the Borgne barrier and Seabrook gate complex (IER #11 Tier 2 Pontchartrain and IER #11 Tier 2 Borgne). Data presented to date, indicate that surface DO concentrations (less than 20 ft in depth) remain relatively high (greater than 4 mg/l) across all sampling dates; however, periodic anoxic events have been identified during the summer months at a depth of 40 ft (appendix G). It is anticipated that a report will be prepared detailing the final results of the DO and salinity data collection efforts in 2013. Those data and interpretation of changes in DO and salinity will be utilized by CEMVN to evaluate alternatives for providing rectification or mitigation to offset adverse impacts, if the cumulative impacts from the structures on water quality are determined to be detrimental to the Lake Pontchartrain estuary and fisheries.

The cumulative HSDRRS construction activities would also cause sedimentation and contamination of waterways from stormwater runoff during rain events. Alterations in water quality from sediment loading adversely impact fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fish and other aquatic organisms from sediment suspension and siltation in waters adjacent to the HSDRRS area include clogged gills, reduced growth rates, and disruption of egg and larval development.

Construction-related damages to open water habitats classified as EFH or containing SAV and wetlands habitat will be fully mitigated through formal mitigation planning. Cumulative impacts of HSDRRS projects on fisheries and fish habitat are anticipated to result in the same level of impacts (moderate to minor) as previously described within each of the sub-basins.

4.2.5.3.2 Cumulative Impacts of Present and Future Regional Actions

The cumulative impacts on fisheries and fish habitat resulting from other present and future regional actions would be similar in nature to many of the previously identified HSDRRS-related impacts occurring within the region's sub-basins and parishes. Present and future regional actions include storm damage reconstruction, redevelopment, coastal and wetlands restoration, flood risk reduction, and transportation projects.

Storm Damage Reconstruction

Present and future regional storm damage reconstruction projects would have little to no direct effect on fisheries or fish habitat. Minor indirect adverse impacts from reconstruction project activities could cause sedimentation and contamination of waterways from stormwater runoff during rain events. Alterations in water quality from sediment loading adversely impact fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fish and other aquatic organisms from alterations in water quality (sediment suspension, siltation, and turbidity) in waters adjacent to the regional storm damage reconstruction projects would include clogged gills, reduced growth rates, and disruption of egg and larval development. Potential impacts on fisheries from the regional storm damage reconstruction projects would be minimized through the use of general construction BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport). However, present and future regional storm damage reconstruction projects are not anticipated to significantly contribute to the cumulative impacts on fisheries or fish habitat, and are thus considered minor.

Some storm damage reconstruction projects could result in beneficial impacts on fisheries and fish habitat. Reconstruction of coastal parks and interpretive trails would encourage fisheries education and conservation. Renovation and creation of commercial and public boat launch facilities would provide greater opportunities for fishermen to supply fisheries landing data. These data would be critical to measuring the impacts and recovery of recreational and commercial fisheries in Louisiana waters.

Redevelopment

Most present and future redevelopment projects would occur in urban areas. Some projects would temporarily impact local drainage during construction. Large-scale development projects would have a permanent impact on fisheries when wetlands utilized as fish habitat would be filled, and expansive impervious parking areas potentially constructed.

Impacts on fisheries could occur from an increase in impervious land use that would result in increased water quality degradation from non-point source pollutants in the local water bodies. These potential impacts on fisheries from the redevelopment projects would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) and project SWPPPs. Present and future regional redevelopment projects are not anticipated to significantly contribute to the cumulative impacts on fisheries or fish habitat.

Coastal and Wetlands Restoration

Restoration projects improve wetlands quality by collecting and filtering sediment and nutrients, and by reducing soil erosion. In addition, coastal and wetlands restoration projects would increase plant biodiversity and provide improved fish habitat. Coastal and wetlands restoration projects would provide cumulative benefits to fisheries in southeast Louisiana through the creation of habitat and forage areas. The State of Louisiana has initiated a series of programs and projects designed to offset the loss of wetlands and EFH (appendix L). State and Federal projects are anticipated to slow and reduce the continued loss of wetlands and quality fish habitat within coastal Louisiana.

- St. Charles sub-basin
 - The Bonnet Carré Freshwater Diversion project would improve wetlands in the region by reducing saltwater intrusion and increasing the production of local fisheries such as oyster, white shrimp, blue crab, Atlantic croakers, and Gulf menhaden. It is estimated that 10,500 acres of marsh and swamps adjacent to Lakes Maurepas and Pontchartrain would be saved over the 50-year project life (USACE 2011b).
- Jefferson East Bank and Orleans East Bank sub-basins
 - The MRGO Deep-draft De-authorization and associated ecosystem restoration project would positively impact area wetlands and habitat within Lake Pontchartrain by helping prevent high salinity waters from entering Lake Pontchartrain via the IHNC. The project would restore and protect 58,861 acres of habitat in the study area, including 13,950 acres of fresh/intermediate marsh, 33,966 acres of brackish marsh, 10,340 acres of cypress swamp, 455 acres of saline marsh, and 48 acres of ridge habitat. In addition, the project includes 70 miles of shoreline protection along the MRGO, Lake Borgne, and Biloxi Marsh (USACE 2010a).
- New Orleans East sub-basin
 - The Bayou Sauvage NWR Hydrologic Restoration project Phase 1 and Phase 2 has been completed and resulted in 2,830 acres (1,104 AAHUs) of created, restored, or protected wetland acres (CWPPRA 2011).

- Chalmette Loop sub-basin
 - The Violet Canal Freshwater Diversion is expected to have a significant beneficial effect on the water quality conditions of Central Wetlands area by diverting approximately 4,000 cfs of freshwater into the area and creating 49 (38 AAHUs) acres of marsh in shallow open water, in addition to protecting 207 acres of wetlands. It is expected to increase fine sediment transport and deposition into the marshes located between the Mississippi River and the MRGO, thereby lowering the salinity in the Central Wetlands. The reduction in salinity may allow vegetation adapted to brackish conditions to expand its range and promote a transition of the wetlands back toward their natural, less saline condition. In addition, the project would include beneficial use of dredged material to create marsh in shallow open water within the project area.
 - The Caernarvon Diversion Outfall Management project would aid in the restoration of former ecological conditions by controlling salinity and supplementing nutrients and sediments to the area. This project could potentially prevent 95 percent of the marsh loss predicted for the next 50 years within Breton Sound (LCWCRTF and Wetlands Conservation and Restoration Authority 1998). Approximately 802 acres (504 AAHUs) of wetlands would be created or restored.

Additionally, CWPPRA projects are anticipated to create, restore, or protect 3,528 acres of barrier island habitat and 7,662 acres of marsh habitat. In addition, marsh would be created, restored, or protected through CWPPRA freshwater diversion projects (5,918 acres) and hydrologic restoration projects (5,601 acres) (CWPPRA 2011). Present and future regional coastal and wetlands restoration projects are anticipated to significantly contribute to the cumulative beneficial impacts on fisheries and fish habitat.

Flood Risk Reduction Projects

Flood risk reduction projects would contribute to additional loss of fish habitat through the filling of wetlands due to levee and floodwall expansion. Some projects may result in long-term minor beneficial impacts, such as reducing the likelihood of storm surges eroding marsh and converting wetlands into open water. However, in general, the permanent loss of wetlands and fish habitat due to other past, present, and future flood risk reduction projects is a significant impact. Direct and indirect impacts on fisheries and fish habitat from the flood risk reduction projects would typically be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) as described in the project's SWPPP. Present and future regional flood risk reduction projects include the following:

- Plaquemines Parish New Orleans to Venice Federal Levee System - This project would result in direct, permanent loss of wetlands and open water habitats (USACE 2011d). In addition, the levee improvements would result in short-term water quality impacts such as increased turbidity and sedimentation. Sediment loading adversely impacts fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fisheries include clogged gills, reduced growth rates, and disruption of egg and larval development.
- Larose to Golden Meadow, Louisiana Hurricane Protection Project - Wetlands would be drained and marsh vegetation, SAV, and wildlife (e.g., shellfish, benthic organisms, and fish) would be destroyed. These areas would no longer be utilized for breeding, foraging, or nursing habitat for a variety of fish species.

- Morganza to the Gulf - This project would cause the loss of fresh, brackish, and saline marshes (USACE 2002). Approximately 15 of the 72 miles of proposed levees would cross estuaries that are currently open to estuarine exchange, but several water control structures in the levees would allow hydrologic exchange. Hydrologic modifications would adversely impact fisheries by increasing fragmentation of the emergent marsh habitat and altering natural hydrologic sheet flow, sedimentation processes, and recruitment and migration of important estuarine aquatic organisms needed to sustain the fisheries food web.
- Grand Isle - The project (see section 3.1.6) adversely impacted over 1,000 acres of nearshore bottoms (USACE 1979). The project resulted in short-term water quality impacts such as increased turbidity and sedimentation. Sediment loading adversely impacts fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fisheries include clogged gills, reduced growth rates, and disruption of egg and larval development. Dredging disturbed the estuarine water bottoms and destroyed non-mobile aquatic benthic organisms. Stockpiling of sand and clay would impact fisheries utilization of nearshore beach habitat, intertidal flats, and shallow estuarine waters.
- SELA - Wetlands impacts from this project would include temporary loss of established benthic fish habitats either through dredging or by replacing natural substrates with cement. Sediments would settle over time and provide some fish habitat, even on man-made substrates. Vegetation removal in canals and canal edges would cause temporary impacts on fisheries and fish habitats by increasing water temperatures and decreasing available DO in the water. Riprap placed on the canal banks may hinder vegetation growth, but potentially would provide additional fish habitat for smaller prey species. Some fish species would be displaced, but would return to the area after construction is complete.
- IHNC Lock Replacement - Freshwater marsh and low-quality wetlands would be impacted from the project. Loss of this potential fish habitat would eliminate its utilization for breeding, foraging, or nursing habitat for a variety of fish species.

Based on historical anthropogenic activities and land use trends in Louisiana, it is assumed that future flood risk reduction projects would have a cumulative adverse effect on water quality and the availability of quality fish habitat, thus adversely impacting fisheries. Cumulatively, all flood risk reduction projects would contribute to wetlands and fish habitat loss and would adversely impact fisheries nursery grounds, migration, and spawning.

However, once flood risk reduction infrastructure is in place, additional benefits to fisheries from reduced erosion would occur. Long-term effects of flood risk reduction infrastructure would slow the erosion of valuable fish habitat by reducing the potential of marsh fragmentation due to high-energy storm surge. Additionally, flood risk reduction infrastructure would provide for improved operations of the overall system in the region. Flood risk reduction projects in Lake Pontchartrain and Breton Sound would result in lower salinity marshes, which could provide a long-term benefit to fisheries by promoting a higher biodiversity of species that may be able to thrive in the lower salinity environment.

Wetlands loss, hydro-modifications, and water quality impacts from construction activities would affect local and regional fisheries (and prey) species through the direct loss of fish habitat, modification of channels used for larval fish movement, and overall degraded habitat water quality. The cumulative impacts on fisheries and fish habitat resulting from the present and future regional flood risk reduction projects would be considered moderate.

Transportation

Present and future transportation projects in the region are anticipated to have little to no cumulative impacts on fisheries or fish habitat, since most of the projects are proposed for construction in previously disturbed areas. Present and future regional transportation projects include the following:

- I-10 Twin Span Bridge over Lake Pontchartrain - Loss of this potential fish habitat eliminated its utilization for breeding, foraging, or nursing habitat for a variety of fish species. However, the use of the old I-10 twin spans (60 spans) as artificial reefs provides habitat for hard bottom dwelling organisms. The artificial reefs created a valuable fish habitat for popular recreational fish species including redfish, speckled trout, croackers, sheepshead, and drum.
- I-49 Construction - Wetland habitats serving as fish habitat and supporting local fisheries, would be impacted by the development of I-49. Construction impacts would also affect hydrology (e.g., leveed, pumped, or artificially constricted) and vegetation (e.g., logged or cleared). The construction of I-49 would generate typical roadway pollutants which could flow into drainage ways, adversely impacting fish and their prey species. Construction could also result in increased turbidity in local waters (LADOTD 2007). Increases in turbidity and sediment loading adversely impacts fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fisheries may include clogged gills, reduced growth rates, and disruption of egg and larval development.
- Huey P. Long Bridge Widening - No substantial impact on fisheries is anticipated from the removal of a small area of wetland habitats (less than 2 acres) along the Mississippi River (LADOTD 2005). Piers for this project could eventually provide aquatic shelter and foraging habitat for fish.
- I-12 to Bush, Louisiana - No substantial impacts on fisheries would occur from the filling and disturbance of seasonally flooded wetlands and pine flatwoods (USACE 2012b)

Transportation projects in the area may cause minor impacts on fisheries by increasing the amount of impervious ground surface in the region. This causes an increased rate of flow of stormwater through the system and could cause channel, bed, and bank erosion, as well as scouring of stream banks. Transportation projects, particularly bridge projects, would likely impact fisheries by removing open water habitat. However, rock and fill utilized for transportation projects in and over water bodies may, over time, benefit fisheries by providing additional fish habitat for smaller prey species. The cumulative impacts on fisheries and fish habitat resulting from the present and future regional transportation projects would be considered minor.

4.2.5.3.3 Summary of All Cumulative Impacts for Fisheries

Direct cumulative impacts on fisheries and fish habitat are associated with the actual construction activities, the associated dredge, fill, and material stockpiling activities, water body displacement, and hydrologic modifications to waterways and ecosystems. Indirect cumulative impacts on fisheries and their habitats include adverse effects on fish migratory movements, active/passive transport of fish eggs and larvae, nursery habitat and recruitment of fish larvae and juveniles, water characteristics and organism access to abiotic water quality habitats (e.g., temperature, salinity, turbidity, and DO), organism access to biotic water quality habitats (e.g., protection from predators and food availability), and hydrology and water velocity.

Storm damage reconstruction and transportation projects within the HSDRRS project area are anticipated to result in insignificant cumulative impacts on fisheries or fish habitat, since most of the projects proposed are either limited to upland construction or occur in previously disturbed areas. Flood risk reduction projects often alter existing nearshore habitats and impact interior marshes by impacting the natural processes of hydrology, erosion, subsidence, and saltwater intrusion. Water flow and important fish habitats between the protected side and the flood side of levees often become further fragmented.

Flood risk reduction projects, combined with other regional coastal and marsh restoration projects, would result in fish habitat with greater diversity in structure and interspersion and lower salinity levels. Flood risk reduction projects would also provide beneficial impacts on fish habitat through the reduction of storm surge inundation via increased hurricane protection. Future regional projects also provide opportunities for dredged material from the access channels to be used for marsh rebuilding, and thus fish habitat creation or nourishment.

The cumulative direct and indirect impacts from regional projects that result in the temporary degradation of water quality or the permanent loss of wetlands that serve as quality fish habitat, combined with the current trend of water quality and habitat degradation in southeastern Louisiana, would result in cumulative minor impacts on fisheries and fish habitat within the HSDRRS project area.

4.2.6 Wildlife

4.2.6.1 Affected Environment

This resource is institutionally important because of the Fish and Wildlife Coordination Act of 1958, as amended, and the Migratory Bird Treaty Act of 1918. Wildlife resources are technically important because they are a critical element of many valuable aquatic and terrestrial habitats; they are an indicator of the health of various aquatic and terrestrial habitats; and many species are important commercial resources. Wildlife resources are publicly important because of the high priority that the public places on their aesthetic, recreational, and commercial value.

The natural landscape within the project area consists of marsh, forest, wetlands, rivers, bayous, lakes, and natural water bodies, such as the Mississippi River, Lake Pontchartrain, Lake Cataouatche, and Lake Borgne (LDEQ 2010a). The Mississippi River significantly affects the Louisiana coastal plain where the deltaic cycles have distributed sediment to coastal lands for over 5,000 years (LaCOAST 2010).

The diversity and abundance of wildlife in the HSDRRS project area are dependent on the quality and extent of suitable habitat present. Much of the project area is located in urban areas. Areas along the current floodwalls, canals, and along the shoreline and inshore area of the lakes would present a different habitat for wildlife as compared to previously disturbed urban areas and borrow sites.

In April 2010, an aerial overflight of the entire HSDRRS construction alignment was jointly conducted by the CEMVN and the USFWS. The purpose of the overflight was to look for colonial nesting bird colonies and bald eagles. The only colonial nesting bird colony detected that had not previously been identified was located along the WBV-14.d reach.

Table 4-10 describes the habitat types found in the project areas across the sub-basins. These habitats are shown in figure 4-6. Wildlife habitats present in the HSDRRS project area include:

- Cypress-tupelo swamp
- BLH
- Freshwater marsh
- Intermediate marsh
- Brackish marsh
- Saline marsh
- Open water
- Shoreline/beaches
- Upland forested
- Upland pasture
- Urban/developed

4.2.6.2 Impacts of HSDRRS

4.2.6.2.1 HSDRRS 2011 Impacts

St. Charles Sub-basin

During construction of the levee enlargement and flood-side shift (LPV-03d) and the demolition and installation of T-walls and the modification of the existing gate at the LPV-06a-f project area, a small number of less mobile wildlife species (i.e., mice, reptiles, or nesting birds) were potentially impacted; however, species that are not wetlands-dependent most likely returned following construction completion. The presence of construction-related activities, machinery, and noise was expected to cause wildlife to avoid the area during construction; therefore, indirect impacts occurred on wildlife inhabiting the sub-basin at pre-construction, and this wildlife potentially migrated to other adjacent habitats. This migration did not exceed the carrying capacity of the adjacent habitat during its temporary use. Therefore, there were minor impacts on wildlife in the project area. Wetlands loss from construction activities lasting up to 2.5 years affected local and regional wildlife species through the loss of foraging, nesting, and rookery habitat.

Colonial-nesting wading birds at the LaBranche Wetlands levee migrated to cypress swamp habitats adjacent to the levee corridor (which provides a higher quality wetlands habitat). Impacts lasted approximately two nesting seasons. Colonial-nesting birds potentially returned to their original nesting area following disturbance if the area still provided appropriate nesting, roosting, and foraging habitat. As of July 2011, the rookery was reported to still be in use even after HSDRRS construction activities. Impacts on colonial-nesting wading birds in the LaBranche Wetlands levee were short-term and moderate. A potential colonial nesting site was identified across the Parish Line Canal between Veterans Boulevard and the Louis Armstrong International Airport (IER #2). Prior to construction of all reaches within the St. Charles sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS. Details about the mitigation measures utilized for nesting colonies of birds can be found in section 5.3.1.10.3.

Bald eagles forage and nest within the LaBranche Wetlands (IER #1 and IER Supplemental #1). Per the National Bald Eagle Management Guidelines (USFWS 2007a), all nests and their 660 ft buffer area were outside of the expanded levee footprint; therefore, eagles were not impacted during the HSDRRS project implementation. Minor permanent impacts occurred on wildlife through the loss of wildlife habitat.

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Table 4-10. Wildlife Habitat Type Description and Sub-basin Location

	Habitat Type Description	Sub-basin								
		St. Charles	Jefferson East Bank	Orleans East	New Orleans East Bank	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche
Cypress-Tupelo Swamp	Cypress-tupelo swamps are located in transitional zones between BLH and lower-elevation marsh or scrub/shrub habitats, and flood on a regular basis (see section 4.2.3 Wetlands). These swamps are dominated by bald cypress and water-tupelo, but Drummond red maple, green ash and black willow are also found in these areas. Cypress swamp and cypress-tupelo swamp habitat provide nesting, foraging and cover habitat to support a diversity of animals. Common wildlife species include: southern dusky salamander (<i>Desmognathus auriculatus</i>), alligator snapping turtle (<i>Macrochelys temminckii</i>), wood stork (<i>Mycteria americana</i>), bald eagle (<i>Haliaeetus leucocephalus</i>), and mammals such as the southeastern shrew (<i>Sorex longirostris</i>), southeastern myotis (<i>Myotis austroriparius</i>), Louisiana black bear (<i>Ursus americanus luteolus</i>), and long-tailed weasel (<i>Mustela frenata</i>) (Louisiana Comprehensive Wildlife Conservation Strategy 2005).	X			X		X	X	X	X
BLH	BLH have a varying water regime; they can be seasonally flooded, covered with water much of the year, and other times dry. BLH ecosystems have structural attributes that differ from adjacent ecosystems, providing different habitat features. Dominant vegetation in BLH forests include Chinese tallow, bald cypress, oak species (<i>Quercus</i> spp.), gum, baccharis, and black willow in the tree and shrub stratum, and alligator weed, smart weed, and southern beakrush (<i>Rhycospora microcarpa</i>) in the herbaceous stratum. BLH forests provide valuable habitat for a diversity of wildlife species. The BLH forested wetlands within the HSDRRS project area provide feeding, resting, nesting, and escape habitat to numerous species of game and non-game mammals and commercially important furbearers, as well as songbirds, raptors, migratory and resident waterfowl, wading birds, woodpeckers, and species of amphibians and reptiles. Most of the BLH in the HSDRRS project area are disturbed and contain large concentrations of invasive Chinese tallows (see section 4.2.3 Wetlands).	X		X	X	X	X	X	X	X
Freshwater Marsh	Freshwater marsh communities are generally located adjacent to brackish marsh along the northernmost extent of the brackish marshes, although they may occur beside coastal bays where freshwater input is entering the bay. Small pools or ponds may be scattered throughout these communities. The freshwater marsh communities are often dominated by cattail, waterlilies (<i>Nymphaea</i> spp.), irises (<i>Iris</i> spp.), duckweeds (<i>Lemna</i> spp.), cutgrasses (<i>Leersia</i> spp. and <i>Zizaniopsis</i> spp.), wild rice (<i>Zizania</i> sp.), and bulltongue. This marsh type provides important nesting and foraging habitat for wintering waterfowl, alligator (<i>Alligator mississippiensis</i>), wading birds, and fish.		X	X	X			X	X	X
Brackish Marsh	Brackish marshes are found between freshwater and saline marshes and experience irregular tidal flooding. The dominant vegetation includes baccharis, marsh-elder (<i>Iva frutescens</i>), chairmaker's bulrush (<i>Schoenoplectus americanus</i>), and saltgrass. Shrimp, crab, redfish, seatrout, and menhaden all use brackish marshes for nursery areas, and like freshwater marshes, brackish marshes are important habitat for waterfowl, shorebirds, and wading birds.	X	X	X	X	X		X	X	X

Table 4-10, continued

	Habitat Type Description	Sub-basin								
		St. Charles	Jefferson East Bank	Orleans East	New Orleans East Bank	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche
Saline Marsh	Saline marshes are found adjacent to or at the interface of coastal lands with the open waters of the Gulf of Mexico and are dominated by smooth cordgrass. Saline marshes act as a nursery area for many species of fish and crustaceans similar to freshwater and brackish marshes. Other wildlife common in saline marsh include wading birds, shorebirds, small mammals, and polychaetes.		X	X	X	X				
Open Water	Open water habitat within the project area consists of ponds, lakes, canals, bays, and bayous. Natural marsh ponds and lakes are typically shallow, ranging in depth from 6 inches to over 2 ft. Typically, the smaller ponds are shallow and the larger lakes and bays are deeper. In fresh and low salinity areas, ponds and lakes may support varying amounts of SAV and floating-leaved vegetation. Marine mammals and brown pelican (<i>Pelecanus occidentalis</i>) are known to occur in the inshore bays and estuaries. Within Barataria Bay, many of the interior canals are dominated by low water quality tolerant fish species (USACE 1996). Sea turtles with the potential to occur in this habitat are protected species (See section 4.2.8 Threatened and Endangered Species). Brown pelicans feed in shallow estuarine waters and use sand spits and offshore sand bars as resting and roosting areas. The diversity of species increases in larger canals such as the Outer Cataouatche Canal and Bayou Segnette due to their moderately improved water quality, allowing for a mixture of fresh and saltwater species.	X	X	X	X	X	X	X	X	X
Shoreline/Beaches	The vegetation community within the shoreline habitat consists of a narrow zone of marsh grass, such as salt grass and bulrush that grows along or among the riprap in some segments of the shoreline. Shorelines and beaches in the HSDRRS project area provide limited habitat for wildlife and are primarily utilized as a resting and foraging area for wading birds.		X	X	X					
Upland Forest	The upland forest habitat is comprised of young, commercial pine forests. These forests do not support the diversity of plant and animal species that were once supported by the historic longleaf pine (<i>Pinus palustris</i>) forests. This habitat provides vital breeding, wintering, and migratory habitat for many migratory non-game bird species. Both game and non-game mammals utilize managed upland forests. Predators of small mammals such as gray fox (<i>Urocyon cinereoargenteus</i>) also utilize upland forest habitat (Allen et al. 1996). Small mammals may include harvest mouse (<i>Reithrodontomys</i> spp.), hispid cotton rat (<i>Sigmodon hispidus</i>), oldfield mouse (<i>Peromyscus polionotus</i>), and striped skunk (<i>Mephitis mephitis</i>). Upland hardwood forests/scrub/shrub habitats are described in section 4.2.4 Uplands. Similar species of woody vegetation can be found in scrub/shrub habitat as is found in BLH (described previously in the table).				X					

Table 4-10, continued

	Habitat Type Description	Sub-basin								
		St. Charles	Jefferson East Bank	Orleans East	New Orleans East Bank	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche
Upland Pasture	Upland pastures are relatively open with little to no woody vegetation rarely inundated with water. Vegetation in pastures consist of bermuda grass (<i>Cynodon dactylon</i>), bahiagrass (<i>Paspalum notatum</i>), dallisgrass (<i>Paspalum spp.</i>), and possibly smut grass (<i>Sporobolus indicus</i>). Pasture areas are not high-quality habitat for wildlife, but they do support a variety of herbivorous species (e.g., deer [<i>Odocoileus virginianus</i>], rabbit [<i>Sylvilagus spp.</i>], mice [<i>Mus musculus</i>], rats [<i>Rattus rattus</i>]), turkey (<i>Meleagris gallopavo</i>), quail (<i>Callipepla spp.</i>) and their predators (e.g., coyote [<i>Canis latrans</i>]). Many bird species (e.g., cattle egret [<i>Bulbulcus ibis</i>]) also forage on seeds and insects in the pasture areas. Pasture areas provide excellent habitat for quail, doves (<i>Zenaida sp.</i>) and rabbits. Amphibians are abundant in ditches, tanks, or wherever water pools.			X	X	X		X	X	X
Developed or Disturbed Area and Urban Habitat	Generally low-quality habitat for wildlife. Wildlife that is most adapted to development is found in these areas and can be found within green spaces and parks, as well as neighborhoods. Common amphibians and reptiles include eastern garter snake (<i>Thamnophis sirtalis sirtalis</i>), Fowler's toad (<i>Bufo woodhousii fowleri</i>) and Gulf coast toad (<i>Bufo valliceps</i>). Mammals common to developed or urban habitats include raccoon (<i>Procyon lotor</i>), Virginia opossum (<i>Didelphis virginiana</i>), nine-banded armadillo (<i>Dasypus novemcinctus</i>), rabbits, grey squirrels (<i>Sciurus carolinensis</i>), mice, rats, and feral dogs and cats. Birds in this habitat type include the American crow (<i>Corvus brachyrhynchos</i>), songbirds, pigeons, and raptors.	X	X	X	X	X	X	X	X	X

Source: Conant and Collins 1998, Whitaker 1998, Moore et al. 1993, Dunn and Alderfer 2006, Moore et al. 1992, Whitaker 1998, Wigley and Lancia 1998, Felley 1992, NOAA 2008, Abadie et al. 2000, Allen et al. 1996



Figure 4-6: Wildlife Habitat Types within and adjacent to the HSDRRS Project Area

Jefferson East Bank Sub-basin

Impacts on wildlife from specific projects within the Jefferson East Bank sub-basin vary due to the project objective, location, previous disturbance, and pre- and post-construction monitoring; however, minor permanent impacts occurred in the sub-basin through the loss of wildlife habitat. Most adverse impacts were short-term in nature and occurred during and immediately after the construction period. Prior to construction of all reaches within the Jefferson East Bank sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS.

The HSDRRS activities in the Jefferson East Bank sub-basin, such as increasing the height and width of floodwalls and ROW and construction of additional foreshore protection and wave attenuation features in the project area, had short-term minor impacts on wildlife habitat in the project area (up to 2.5 years). The presence of construction-related activity, machinery, and noise was expected to cause most species of birds and mammals to avoid the project area during construction, or displace wildlife populations from the project area. Low-quality wildlife habitat was temporarily affected because the modified footprint removed mowed grass (turf grass); however, after construction, the expanded levee was seeded with turf grass and the existing habitat was restored. Therefore, impacts on wildlife were negligible. Local populations of colonial-nesting birds had the potential to be temporarily impacted during construction, but similar inspection procedures as discussed in the St. Charles sub-basin section were implemented for colonial-nesting birds and bald eagles, thereby minimizing the potential for disturbance during construction. Although birds were able to relocate during levee and foreshore protection construction, less mobile wildlife (e.g., mice, lizards, and toads) potentially became casualties; but due to their current population sizes, this was a minor impact on wildlife populations.

The construction of foreshore protection and wave attenuation features required dredging and stockpiling of soils (on land and flotation channels) which caused wildlife to avoid the area, causing short-term, minor adverse impacts on wildlife in the project area. These impacts were not expected to extend beyond the construction period (approximately 2.5 years). Adverse impacts at land stockpile areas were minimized due to the ability of birds and mammals to move to adjacent terrestrial habitats during construction. Following construction, the terrestrial habitat used for stockpiling soils had the potential to be used again by wildlife. Direct, short-term impacts at water-based stockpiles were moderated by the relatively small area of shoreline and aquatic habitat that was affected. Birds resting and foraging in the shoreline habitat around Lake Pontchartrain were not likely affected by shoreline construction, because similar available habitat exists nearby. Excavated sediment from dredging activities was used to backfill the channels, and as a result, these areas could be recolonized after construction by benthic invertebrates and fish that are prey for waterfowl and other birds. Therefore, this action was expected to have a short-term, minor impact on wildlife species.

Although high-quality wildlife habitat near LPV-03a (near the Louis Armstrong New Orleans International Airport) was permanently impacted (i.e., replaced with floodwall and associated stability berms), most species of birds and mammals were likely to relocate to nearby extensive wetlands and shoreline habitats. Therefore, the impacts on wildlife were short-term and minor.

The LaBranche Wetlands are in the vicinity of the project described by IER #2 and IER Supplemental #2 and experienced impacts similar to those previously mentioned for the St. Charles sub-basin. Two wetlands areas within the IER #3 and IER Supplemental #3.a project provided habitat for wildlife species that frequent terrestrial and brackish aquatic habitats. Impacts on wildlife inhabiting these wetlands areas were similar to those described in the St. Charles sub-basin.

Although migratory bird species are known to roost in the vicinity of the Causeway Bridge (Reach LPV-17) project area, they are mobile and avoided the project area during construction.

Displaced individuals likely returned to the impacted areas following project completion; therefore, impacts on wildlife were short-term and minor.

Orleans East Bank Sub-basin

Low-quality wildlife habitat (e.g., mowed turf grass and staging areas) was temporarily impacted during construction, but was revegetated post-construction. Therefore, potential effects on terrestrial wildlife were minor and short-term and no permanent impacts occurred. Direct impacts such as the presence of construction machinery, noise, and other construction activities caused the predominant wildlife (birds) to avoid the construction areas, and some less mobile animals were impacted during construction. However, the impacts on local and regional wildlife were negligible. Temporary, localized impacts on wildlife occurred from the Orleans Avenue, 17th Street, and London Avenue canals' pump station construction activities, as described in the Jefferson East Bank sub-basin section. A portion of the Orleans Avenue and London Avenue canals project area encompasses green space (along the outfall canal). Impacts on avian and other mobile species were short-term and minor because there was similar habitat nearby.

Prior to construction of all reaches within the Orleans East Bank sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS. The removal of a limited number of trees within the project footprint near Bayou St. John (LPV- 103) resulted in an additional, minor reduction in habitat for birds and other wildlife in the area. However, the removal of this habitat caused a negligible impact on birds and other wildlife because of the expanse of similar habitat in the vicinity.

Open water habitat of Lake Pontchartrain and marshlands in the project vicinity were not affected by the construction at the canal pump stations; however, lake bottom habitat would be lost from breakwater structures that are part of the final design for the outfall canal closure structures. As a result, fisheries resources were impacted in the short term and on a local level (see section 4.2.5 Fisheries), which affected food sources for fish and other wildlife. Upon completion, neither wildlife activities nor habitat were impacted by the operation and maintenance of the new pump stations.

Temporary, localized impacts on wildlife nesting, fishing, and flyways resulted from the Orleans, 17th Street, and London Avenue Canals construction activities (IER #5 and #27). However, these temporary impacts did not impact the long-term activities or habitat of the area wildlife. Wildlife species generally dispersed from the area during construction, but potentially returned to the area following completion.

New Orleans East Sub-basin

The new floodwall (IER Supplemental #6) eliminated the existing terrestrial wildlife access to Lake Pontchartrain along the levee reaches, which potentially impacted species such as nutria (*Myocastor coypus*), red fox (*Vulpes vulpes*), raccoon, Virginia opossum, and nine-banded armadillo. However, this area is fragmented and not considered high-quality wildlife habitat; therefore, these permanent impacts were negligible. The loss of BLH forested wetlands along the LPV-109 and along LPV-111 levee reduced the available habitat for wading and neotropical birds in the project area.

All levee improvements in the sub-basin temporarily disturbed and displaced wildlife utilizing the habitats along Lake Pontchartrain. However, wildlife potentially utilized the nearby habitats in Bayou Sauvage NWR. Therefore, impacts on wildlife species were negligible. Wildlife utilizing habitat at staging areas along Hayne Boulevard and New Orleans Lakefront Airport were temporarily disturbed during construction activities. However, due to the low quality of the habitat in these areas, impacts on wildlife were negligible.

Activities associated with raising the existing levee temporarily impacted foraging habitat for ducks and wading birds. Prior to construction within the New Orleans East Bank sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS. Wildlife habitat (birds, small mammals, and fish) in Bayou Savage was permanently lost, which had a localized moderate impact on wildlife in the sub-basin. Loss of fisheries impacted avian, mammal, and reptile species, as the food web was disrupted.

The Borgne barrier alignment (IERs #11 Tier 2 Borgne and IER Supplemental #11 Tier 2 Borgne) continued to allow movement of marine wildlife such as dolphins and manatees (*Trichechus manatus*; see Threatened and Endangered Species section 4.2.8) between the eastern and western sides of the structures through open gates. Therefore, the movement of the animals was only affected in the short term during construction. Dolphins and birds had the potential to be adversely affected if changes in hydrology and water quality affected their prey; however, results from hydrological modeling and monitoring predicted that these impacts were negligible. The infrequent and slow operation of the GIWW and Bayou Bienvenue gate structures would have little to no adverse impact on wildlife.

Construction and clearing of areas for the gate structures on the bank of the GIWW (sector gate and bypass barge gate), the braced concrete wall (barrier) on the bank of the MRGO, and gate structures (a sector gate and two vertical lift gates) on the banks of the IHNC caused negligible impacts on wildlife because the footprint was located in marginal, mainly grassy areas which did not provide important habitat for wildlife. The clearing of scrub/shrub habitat in a 16-acre staging area on the west bank of the MRGO caused short-term impacts on wildlife during construction (up to 3 years). Also, wildlife inhabiting the staging area currently leased from the Port of New Orleans potentially relocated to similar habitat on adjacent shorelines. Therefore, impacts on wildlife were short-term and minor.

Aquatic wildlife using marsh and open-water habitats in the project area are mobile and likely relocated at the start of construction activities; thus, these activities caused temporary, minor impacts on wildlife. Pile driving in the GIWW, MRGO, and IHNC had the greatest potential to cause adverse effects on aquatic individuals (e.g., marine mammals, turtles, and fish) in the vicinity because the activities were adjacent to and in open-water habitat. Noise and traffic at the construction site deterred aquatic species from remaining in the vicinity of the project area. However, during the construction of the Seabrook gate complex (sector gate and two vertical lift gates) at the IHNC, the cofferdam prevented bottlenose dolphins (*Tursiops truncatus*) and other aquatic wildlife from passing between Lake Pontchartrain and the IHNC, and thereby minimized impacts on these species. The inability of the wildlife to pass through the cofferdam did not adversely impact these species, as there is no known migration route in the vicinity. Additionally, other passage routes are available from the Gulf of Mexico to the IHNC and Lake Pontchartrain. The use of standard measures outlined for threatened and endangered species (detailed in section 4.2.8 Threatened and Endangered Species) further protected and minimized adverse impacts on aquatic species.

Impacts on wildlife occurred at all of the HSDRRS borrow areas in the sub-basin from the loading and unloading of material and increased traffic on associated roads leading to the borrow sites. Borrow sites in the sub-basin (e.g., Cummings North, Maynard, Eastover Phase I, Eastover Phase II, Stumpf Phase I, and Stumpf Phase II) displaced wildlife when the areas were cleared and excavated. The impacts occurred due to the loss of foraging and nesting habitat. Once material was excavated, the areas were potentially converted to aquatic habitat (see section 4.2.5 Fisheries). If the borrow sites were colonized by aquatic vegetation, wildlife such as otters (*Lontra canadensis*), alligators, raccoons, wading birds, and ducks would expand their range into the new habitat. Other vegetation potentially colonized the zone adjacent to the aquatic environment. Over time this zone would provide habitat for nesting, foraging, and cover for wildlife. Borrow sites that remain dry were colonized with herbaceous and woody vegetation

and offset loss of habitat on wildlife. Dense vegetation attracts a variety of wildlife species, including, avian, reptiles, amphibians, small mammals, mosquitoes (family Culicidae), and other insects. Mosquitoes are a food source for bats and birds. Eagle nests occurred near some of the HSDRRS borrow sites; however, the nests were outside of the 660 ft buffer zone required by USFWS. The USFWS concurred with the USACE through correspondence on May 29, 2007 that the HSDRRS borrow areas were not likely to adversely affect bald eagles or their critical habitat. As of July 2011, the Maynard, and Eastover Phase I and II were the only borrow sites in this sub-basin utilized for the HSDRRS construction.

Site-specific impacts occurred on wildlife habitat that utilized the Eastover Phase II borrow site ponds before excavation. However, the wildlife habitats associated with these ponds and open land area were of low wildlife value overall. The loss of mature BLH impacted wildlife as mobile fauna relocated to adjacent habitat and non-mobile fauna were destroyed. The area was converted to ponds and small lakes if water was retained after construction activities, or to uplands if herbaceous and woody plants, affected soil porosity and did not allow for water to be retained.

Chalmette Loop Sub-basin

Permanent impacts on wildlife were moderate due to loss of upland habitat and impacts on wetlands. The construction of the control structure at Bayou Dupre did not result in the loss of quality wildlife habitat because the footprint of the new structure on each bank of the bayou remained in areas currently covered by riprap. The presence of construction-related activity, machinery, and noise during construction had short-term, minor impacts on wildlife at the location of the control structure and nearby wildlife habitats. Operation of the sector gate will be relatively slow but infrequent, and therefore these operations would have negligible impacts on wildlife.

The Caernarvon Canal Floodwall (LPV-149) construction resulted in minor adverse permanent impacts on wildlife, as forested wetlands habitat was lost where new floodwalls were constructed, in temporary staging areas, and along both banks of the canal. Adverse short-term impacts on wildlife occurred during construction due to machinery movement and noise. However, birds and other mobile species generally relocate during construction; therefore, impacts were minor.

Prior to construction of all reaches within the Chalmette Loop sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS. There is one eagle nest in the area; a survey was conducted prior to the start of construction. As determined through coordination with USFWS, a greater than 330 ft buffer zone was present between the active nest and the construction area; therefore, no additional monitoring was required. No impacts on nesting bird colonies were expected from any of the HSDRRS actions in this basin and colonies were not documented in the project vicinity. However, bald eagles were recorded near the Verret to Caernarvon levee reach to the east of the floodwall and canal.

Approximately 1,536 acres of terrestrial wildlife habitat was temporarily lost to wildlife during construction of the T-wall on the Chalmette Loop levee. However, efforts to minimize impacts on wildlife during construction occurred throughout the HSDRRS project area. The USACE constructed nine wildlife openings (earthen ramps with roller gates), which facilitate terrestrial wildlife movement across the T-wall, with three openings located at LPV-145, three openings located at LPV-146, and three openings located at LPV-148, as shown in figure 4-7 and photograph 4-2, and wildlife have been observed utilizing these openings (photograph 4-3). In addition, other railroad and roadway gates have also been utilized by animals as terrestrial crossings (18 total crossings) in the 22-mile-long Chalmette Loop levee portion of the HSDRRS.

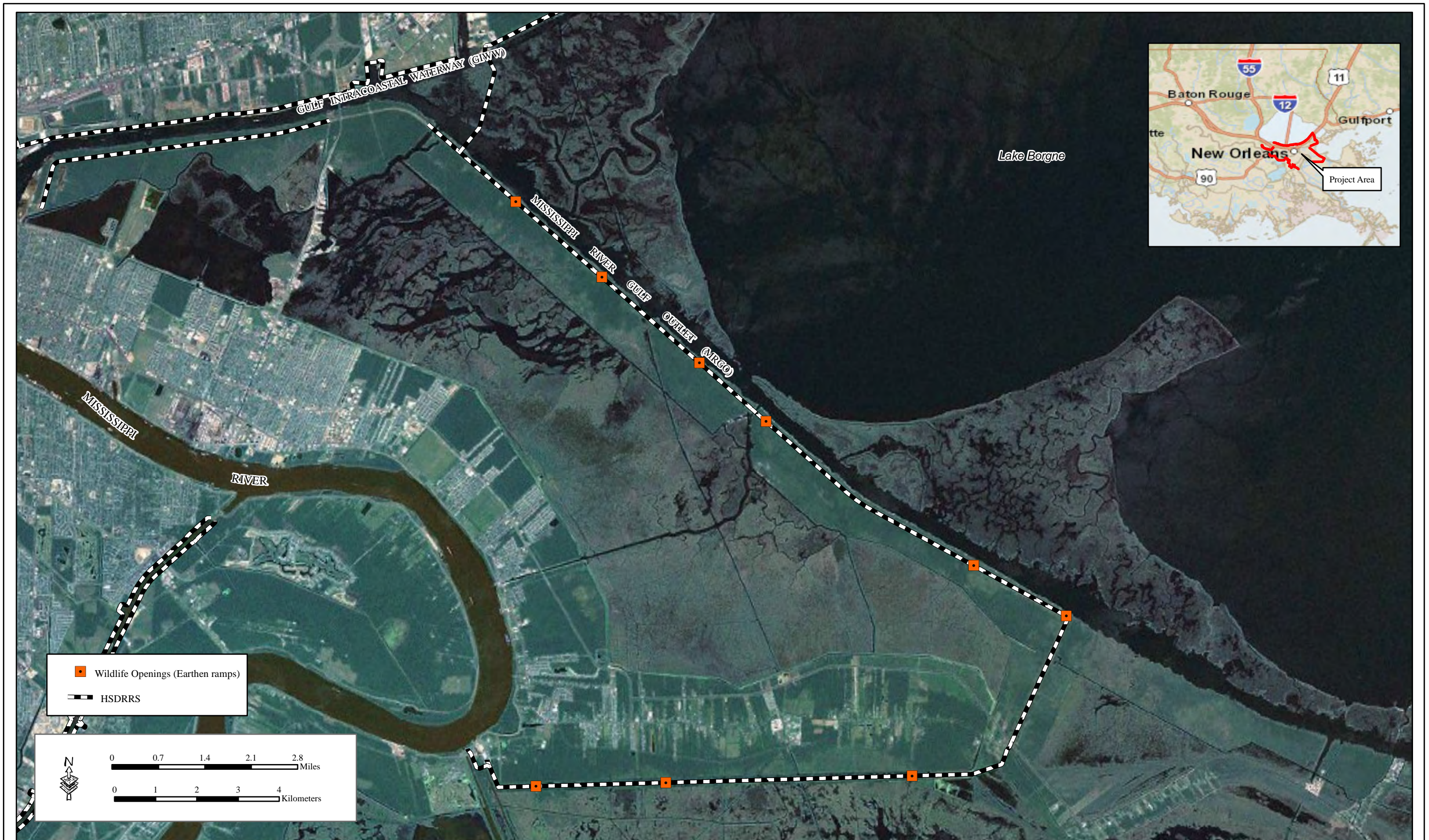


Figure 4-7: Wildlife Openings along the HSDRRS IER #10 Project

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Clearing and grading activities caused mortality in smaller, less mobile wildlife such as small mammals, amphibians, and reptiles. Larger more mobile animals generally relocated as previously discussed.



Photograph 4-2. Wildlife opening in the Chalmette Loop Levee T-wall



Photograph 4-3. White-tailed deer utilizing a wildlife opening

Similar impacts on wildlife occurred at all of the HSDRRS borrow areas in the sub-basin. At some borrow sites in the sub-basin, no adverse impacts on wildlife would occur (e.g., 910 Bayou Road, 1418/1420 Bayou Road, 1572 Bayou Road, Dockville) but these areas would benefit wildlife if restored to aquatic habitat and/or herbaceous and woody habitat post-excavation. At the 1418/1420 Bayou Road and 1572 Bayou Road borrow sites, young non-jurisdictional BLH would be impacted; therefore, adverse effects on wildlife would occur as previously mentioned in borrow impacts in the New Orleans East sub-basin. Impacts on wildlife at borrow sites such as DK Aggregate, Sylvia Guillot, and Johnson/Crovetto were similar to those described for borrow sites in the New Orleans East sub-basin (see section 4.2.6.2.10). As of July 2011, 910 Bayou Road, 1418/1420 Bayou Road, 1572 Bayou Road, DK Aggregate, Sylvia Guillot, and the Johnson/Crovetto borrow areas have not been used for the HSDRRS 2011 construction.

The Contreras Dirt borrow area pre-construction consisted of 363 acres of fallow sugarcane field and non-jurisdictional BLH. As previously mentioned, the site became aquatic habitat after borrow material excavation. Cells E, F, and Z of this contractor-furnished borrow area were dominated by 225 acres of non-jurisdictional BLH, with high habitat value for wildlife species typical of the area. The construction impacts on BLH wildlife species, such as nutria, red fox, raccoon, Virginia opossum, and nine-banded armadillo, caused habitat fragmentation or loss of habitat. Additional impacts included mortality in smaller, less mobile wildlife, such as small mammals, amphibians, and reptiles, due to clearing and grading. Larger animals potentially relocated.

Belle Chasse Sub-basin

Direct impacts from the Hero Canal Levee and Eastern Tie-in project (IER #13) occurred on cypress-tupelo swamp south of the canal that functions as part of the Barataria Bay Basin. This resulted in permanent minor impacts on wildlife and avian species, especially those that depended on shellfish as a food source. Construction of a new pump station at the closure structure increased suspended solids in the water column and had an indirect effect on wildlife that foraged on aquatic organisms (see section 4.2.5 Fisheries).

Construction of the stoplog gate had a direct impact on wildlife that utilized the canal for migration to and from the Barataria Bay Estuary. Removal of the abandoned barges reduced wildlife habitat for previously mentioned aquatic species and potentially affected water temperature, which had a short-term, minor effect on wildlife.

The new earthen levee constructed in the sub-basin impacted surrounding BLH, and ultimately impacted wildlife. A sluice gate allowed normal precipitation to flow through and will only be closed during storm events; therefore, impacts on wildlife only occurred if individuals were to be trapped outside the floodgate during a storm. Installation of gates and pump stations across Hero Canal temporarily disrupted open water fish habitat during construction, thus altering the trophic structure for many wildlife species, and caused short-term minor impacts on wildlife. The pump station will be operational during a storm event, which causes increased velocities and could potentially trap wildlife in ancillary structures. The projects' vehicular and railroad gates will be closed during storm events, which could potentially trap wildlife on the flood side of the levee during storm events, causing localized adverse impacts on wildlife. Construction of the project components in the sub-basin disturbed wetlands biota and sediments in the project area and impacted downstream fisheries and avian feeding areas due to increased turbidity and sedimentation. The overall condition of aquatic habitats returned to pre-construction levels after construction was completed, allowing for recovery of resident fish species and reestablishment of vegetative cover. Prior to construction of all reaches within the Belle Chasse sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS.

Benefits for wildlife related to conversion of dry land to ponds and/or small lakes at the Westbank N borrow site were similar to those previously described in the Cummings North and Maynard borrow discussion found under New Orleans East sub-basin. The Westbank N borrow site was utilized for the HSDRRS construction, but as of July 2011, the Cummings site has not been used.

Gretna-Algiers Sub-basin

The WCC activities directly impacted wetlands habitat used by local wildlife. Wildlife in wetlands were potentially dispersed to adjacent habitat; therefore, minor permanent impacts on wildlife were expected. The greatest effect on wildlife was associated with construction activities (e.g., noise and machinery movement), which occurred for approximately 4 years.

Levees did not act as a barrier for a majority of the native species; however, floodwall construction hindered migration of native species and, over time, will impair the genetic drift between populations. Less mobile and wetlands-dependent species (i.e., mice, reptiles, and amphibians) were lost during construction; however, most species avoided the construction sites. The western earthen levee enlargement had short-term, localized impacts on wildlife in the project area during the filling of the canal. There were negligible impacts on wildlife with the northern levee floodwall cap and water control structure construction, as the project area provided low-quality habitat and wildlife relocated to nearby habitat.

Other impacts associated with noise and vibration, gate structure operation, dredging, hydrological augmentations, water quality, and loss of wetlands were similar to those previously discussed in other sub-basins. Dredged material from the Algiers Canal was placed into JLNHPP Lake Salvador geocrib to create wetlands habitat.

The USACE, prior to construction of all reaches within the Gretna-Algiers sub-basin, conducted coordination and surveys for nesting colonies of birds in conjunction with the USFWS. No impacts on nesting colonies or bald eagles were expected in this sub-basin, as they were not documented in the project vicinity.

Harvey Westwego Sub-basin

Short-term and permanent minor impacts on wildlife, as previously discussed for other basins, occurred in this project area. In short, the loss of forested wetlands habitat in this project area did not decimate local wildlife populations. Indirect impacts on wildlife related to construction noise, activity, and traffic, and canal filling were similar to those described for other sub-basins.

Wildlife use of approximately 42 acres of cypress swamp adjacent to the WBV-14.c.2 reach was lost due to levee enlargement. The 100 ft wide area was cleared of vegetation and lost possible habitat for nesting birds and general wildlife, and other aquatic wildlife was lost. The swamp habitat was replaced with a vegetated levee. However, mobile wildlife displaced by construction activities would find suitable habitat in the adjacent JLNHPP, located in the Barataria Bay estuary.

In April 2010, a colonial bird nesting rookery was observed during an aerial survey conducted by the USFWS and the USACE. The rookery was adjacent to the WBV-14.d reach. An on-site inspection determined that some nests in the colony were within 125 yards (375 ft) of pile driving operations. This was within the 1,000 ft no-work zone restriction (buffer zone) outlined by the USFWS. The rookery was composed mostly of great egrets with some great blue herons. Based on on-site inspections conducted by the USFWS and USACE where the colony was observed, the USFWS determined that the continued construction activities did not result in a “take” and the work was allowed to continue.

Lake Cataouatche Sub-basin

Permanent displacement of fish (see section 4.2.5 Fisheries) and temporary displacement of wading birds, waterfowl, or other wildlife within the 19-acre dredged island and surrounding shallows occurred. Permanent loss of wildlife habitat occurred in other areas of the project; however, wildlife species potentially relocated to adjacent suitable habitat in the adjacent JLNHPP and the Barataria Bay estuary and only minor permanent impacts on wildlife occurred. Indirect effects on wildlife due to construction (e.g., noise, vibration) within adjacent wetlands or aquatic habitat were short-term. Therefore, impacts on wildlife were short-term and minor.

Prior to construction of all reaches within the Lake Cataouatche sub-basin, coordination and surveys for nesting colonies of birds were completed in conjunction with the USFWS. Bald eagles were not expected to nest within or near the alignments, although they may use the Outer Cataouatche Canal and Bayou Verret for foraging. No impacts on nesting colonies or bald eagles were expected in this sub-basin, as they were not documented in the project vicinity.

The borrow sites, including Churchill Farms Pit A, River Birch Phase I and Phase II, Westbank E Phase I and Phase II, Westbank F (including access), Westbank D, Westbank I, South Kenner Road, Willswood, Acosta 2, Idlewild Stage 2, King Mine, Levis, Lilly Bayou, Port Bienville, Raceland Raw Sugars, River Birch Landfill Expansion, and Scarsdale, all have similar wildlife impacts to those discussed previously in New Orleans East borrow sites. Of these sites, only Churchill Farms Pit A, River Birch Phase I and Phase II, South Kenner Road, Willswood, Acosta 2, Idlewild Stage 2, Lilly Bayou, Port Bienville, and River Birch Landfill Expansion were used for the HSDRRS in this sub-basin. Non-jurisdictional BLH wildlife habitat at the Acosta 2 site and Levis would be lost, mobile fauna would relocate to nearby areas, and non-mobile wildlife would be killed. These impacts would be considered minor.

Nesting birds and their nests were not disturbed or destroyed at the borrow sites which were utilized as of July 2011. Construction contractors were prohibited from conducting any activity within 660 ft from the eagle nest near the River Birch Landfill Expansion site to avoid impacting nesting activity.

Impacts from Borrow Sites Outside of the HSDRRS Sub-basins

Many HSDRRS borrow actions had similar impacts due to the ability of most wildlife species to avoid disturbed areas. However, many species would frequent the project areas while foraging or migrating to other areas.

Following borrow activities, the Bonnet Carré Spillway borrow site was, to the greatest extent practicable, restored with gradual side slopes, irregular shapes, and islands to provide aquatic vegetation in shallow littoral edges of the borrow pit. Wildlife (e.g., otters, alligators, raccoons, wading birds, and ducks) adapted to aquatic environments were expected to inhabit this area. The Spillway structures were operated in 2008 and 2011, and some river water leaks through the needles in the Spillway during all high river water events. Wildlife are displaced during these Spillway opening events, and flooding of the Spillway reworks the land surface. Vegetation, fish, and wildlife all recolonize the Spillway following its operation. This includes borrow sites utilized for HSDRRS construction, which were affected by the 2011 opening, and will be altered and recolonized from future Spillway openings.

Impacts on wildlife occurred at all borrow areas outside the HSDRRS sub-basins from the loading and unloading of material and increased traffic along associated roads leading to the borrow sites. Borrow sites displaced wildlife when the areas were cleared and excavated. Impacts on wildlife at these sites were similar to those described previously in the New Orleans East sub-basin.

Impact on wildlife from the Triumph borrow area would be the same as previously mentioned for the Bonnet Carré Spillway borrow. The Triumph borrow area would impact avian species due to its proximity to the Mississippi River (major flyway and coastal wetlands). As of July 2011, the Triumph borrow site was not utilized for construction.

The St. Gabriel Redevelopment, River Birch Phase 1, River Birch Phase 2, Eastover, Pearlinton Dirt, Gatién-Navy – Camp Hope, Sylvia-Guillot, DK Aggregates, and Kimble #2 borrow sites (all outside of the sub-basin boundaries) would remove non-jurisdictional BLH and/or upland areas. Dry land areas could be converted to aquatic habitats as previously mentioned for other borrow sites. Jurisdictional wetlands were cleared and excavated at the River Birch Phase 1 and River Birch Phase 2 sites; these sites had an existing CWA Section 404 permit (MVN-2004-2721) authorizing dredge and fill activities in wetlands prior to the evaluation for the HSDRRS borrow efforts. Wildlife would be displaced and quality wildlife habitat would be permanently removed from any jurisdictional wetlands areas. Because additional wildlife habitat was adjacent to the borrow sites, impacts on wildlife would be minor. As of July 2011, the St. Gabriel Redevelopment, Gatién-Navy – Camp Hope, Sylvia-Guillot, DK Aggregates, and Kimble #2 borrow sites have not been utilized for construction.

The jurisdictional wetlands of all the borrow sites described in IER #22 and the Tac Carrere site (outside of the sub-basin boundaries) would be avoided. Impacts on wildlife would be similar to those described for the Bonnet Carré Spillway borrow site. As of July 2011, the Tac Carrere borrow site was not utilized for construction.

Two of the five borrow areas discussed in IER #23 and the Tammany Holding area borrow site contain small ponds, where all suitable material was removed from the site. The 1025 Florissant Hwy and Acosta borrow sites contain small ponds that do not support viable fisheries, but may provide habitat for small mammals and avian species by providing a food source. Since the other three sites had no known fisheries resources, similar wildlife impacts occurred at the borrow sites as previously described for upland habitats. Increasing aquatic habitat would encourage wildlife that forage on fish, crayfish, and other aquatic species. As of July 2011, the Acosta, the 3C Riverside, Pearlinton Dirt Phase 2 (IER #23), and the Tammany Holding were utilized for construction.

The Big Shake borrow site is currently farmed for sugar cane and the Henley site is mixed pasture land and active borrow pits. Impacts on wildlife would be similar to those previously discussed for upland grassland sites. As of July 2011, the Big Shake and the Henley borrow sites were not utilized for construction.

The Citrus Lands and Bocage borrow sites consist of pasture land and cattle pasture, respectively. Impacts on wildlife at both borrow sites and the potential for restoration would be the same as in the previously mentioned borrow sites. Wildlife impacts would coincide with impacts on fisheries as discussed in section 4.2.5.2, as fisheries are an important diet of many wildlife species in the area. As of July 2011, the Citrus Lands and Bocage borrow sites were not utilized for construction.

4.2.6.2.2 HSDRRS 2057 Impacts

Wildlife could be directly impacted due to the loss of habitat and foraging areas from future levee lifts expanding into adjacent undisturbed areas, and indirectly impacted by construction-related noise and vibrations, and the potential for a reduction in water quality. An additional 7.3 million cy of fill would be required for future levee lifts, which would result in additional wildlife habitat and foraging areas being cleared and excavated for borrow areas. Mobile wildlife would avoid the areas, but some individuals would be destroyed. A permanent minor impact would result from the additional disturbance of wildlife and loss of habitat.

Prior to construction of future HSDRRS projects, coordination with USFWS would be completed for reaches located near bald eagle nests or nesting bird colonies.

Construction activities associated with raising the foreshore protection would temporarily degrade foraging habitat for ducks and wading birds and could temporarily affect the movement of common wildlife along the shore of Lake Pontchartrain.

4.2.6.3 Cumulative Impacts

4.2.6.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

During construction of the HSDRRS, a small number of less mobile wildlife species (i.e., mice, reptiles, or nesting birds) would be lost; however, most species would return following completion of the construction. Both high- and low-quality wildlife habitat that is both locally and regionally common would be impacted and the cumulative permanent impacts on wildlife would be minor. Most species of mobile organisms would likely relocate to nearby extensive wetlands and shoreline habitats. The presence of construction-related activities, machinery, and noise would be expected to cause wildlife to avoid the area during construction; therefore, indirect impacts would occur on wildlife currently inhabiting the project area, and wildlife would migrate to other adjacent habitats. This migration would not exceed the carrying capacity of the adjacent habitat during its temporary use.

Loss of wetlands and non-jurisdictional BLH habitat from construction activities would affect local and regional wildlife species through a loss of foraging, nesting, and rookery habitat and fragmentation of habitat. Aquatic species (e.g., marine mammals) could experience temporary adverse effects from decreased water quality, pile-driving noise, and other disturbances. The HSDRRS could alter hydrology in the region and restrict access and migration pathways for some aquatic species.

Borrow areas would displace local wildlife during the clearing of land and excavation of materials. Once the material is excavated, however, the areas would be converted to aquatic habitat or scrub/shrub communities, which would offer habitat to some terrestrial and aquatic species. Any potential borrow site utilized for future borrow needs would require environmental clearance and coordination with state and Federal agencies.

4.2.6.3.2 Impacts of Present and Future Regional Actions

Wildlife conservation is extremely important to Louisiana's tourism, aesthetics, outdoor sports (e.g., hunting and fishing), and overall quality of life. As Louisiana's landscape changes with environmental trends, pollution, land use, climate, and loss of natural resources, more focus is given to measures that reduce impacts on wildlife habitat. A balance between the engineering of risk reduction projects and conservation efforts is necessary, and often coincides with other present and future projects. This section of the CED summarizes impacts on wildlife and some of the conservation efforts occurring with other present and future regional actions.

Storm Damage Reconstruction

Most reconstruction projects would have no effect on wildlife because the projects are located primarily in urban areas. Some reconstruction projects have a beneficial effect on wildlife in the region. For example, renovation of the Bartholomew Golf Course would have marginal improvement on wildlife habitat in water traps (aquatic habitat), roughs, and in the tree canopy lining many fairways. Improvements to parks, golf courses, and parkways would provide wildlife habitat for mammals, reptiles, and avian species. Sewage treatment infrastructure enhancement would improve water quality by capturing, controlling, and filtering tertiary runoff. Improved water quality would attract aquatic species that are an important food source for some wildlife species.

Redevelopment

Both residential and commercial redevelopment projects have a potential beneficial impact on wildlife habitat because redevelopment could include new utilities infrastructure (e.g., improved wastewater treatment and underground utilities). Underground utilities prevent harm to avian species by removing overhead lines, reducing the infrastructure footprint on the landscape (by removing impervious materials), and reducing electrocution of climbing animals and birds. In areas where redevelopment is designed as multi-use, cumulative beneficial impacts occur from the inclusion of green space and reduction in carbon emissions, as many are designed to connect communities with bike and pedestrian pathways, with some nature trails and interpretive centers that describe local flora and fauna. Redevelopment often includes rebuilding of libraries, museums, and nature trails that provide information to the general public on wildlife conservation and facilities focused on wildlife rehabilitation. This type of redevelopment has become extremely important since Hurricanes Katrina and Rita and the BP Deep Water Horizon oil spill.

Coastal and Wetlands Restoration

Coastal and wetland restoration projects would provide benefits to wildlife protection and conservation by creating and improving sensitive habitat that is used by a wide variety of species for nesting, hunting, foraging, and rearing. The Gulf coast and its associated wetlands provide important fish and wildlife habitat beyond the geographical reach of the shoreline, dunes, and wetlands areas. Wetlands and coastal areas often serve as nursery habitats for fish, amphibian, reptile, and crustacean species where eggs and immature individuals depend on wet habitats for sustenance. As habitat is degraded or reduced, wildlife suffers population losses. Alternatively, as habitat is improved, created, or restored, dependent wildlife and aquatic species can increase clutch size successes and improve populations. For example, projects sponsored by CWPPRA would create, restore, or protect approximately 3,528 acres of barrier island habitat and 7,662 acres of marsh habitat. In addition, marsh would be created, restored, or protected through CWPPRA freshwater diversion projects (5,918 acres) and hydrologic restoration projects (5,601 acres) (CWPPRA 2011). Shoreline protection, outfall management, terracing, and herbivory control projects would contribute additional benefits for wildlife by enhancing available habitat, creating new wetlands habitat, and protecting existing habitat.

Flood Risk Reduction Projects

Based on historical anthropogenic activities and land use trends in southeastern Louisiana, flood risk reduction projects would degrade water quality, cumulatively adversely impacting wildlife habitat. Wildlife habitat would be converted from one type (i.e., primarily uplands and BLH) to another type (i.e., primarily aquatic) once borrow material is excavated from the borrow areas. Potential benefits for wildlife would be the result of flood risk reduction infrastructure that improves hydrology and reduces erosion. Better operational procedures during flooding events could minimize the devastating effects on wildlife species by controlling the release of floodwater. However, the potential for wildlife to be trapped on the flood side of the system would be a detriment to wildlife. Flood risk reduction projects in Lake Pontchartrain and Breton Sound basins also result in lower salinity marshes, leading to a higher biodiversity, thereby providing a long-term benefit for wildlife.

Transportation

Transportation projects would continue to occur in the sub-basins (e.g., Twin Spans Bridge, Earhart-Causeway Interchange, I-12 to Bush, Louisiana) and construction noise would temporarily impact wildlife. Other transportation projects would include the removal of bridges and drainage culverts, which could be a benefit by improving water quality or could hinder wildlife access to adjacent habitats and ultimately reduce the genetic diversity and fitness of species over time. However, these impacts would be localized and would not be expected to significantly affect the species' regional populations. In some cases, bridge improvements would allow for improved passage and/or allow for shared space between wildlife habitat and residential communities.

4.2.6.3.3 Summary of All Cumulative Impacts for Wildlife

Overall, construction activities associated with the HSDRRS and other regional present and future projects would contribute to the cumulative loss of wildlife habitat and resources within the project area. BLH forests, cypress swamps, marshes, and tidal channels impacted by projects provide habitat for an abundance of amphibians, reptiles, and shellfish. Coastal wetlands, marshes, and forests provide permanent habitat or indirectly serve as breeding and rearing refuge for wildlife. Cumulative impacts from construction activity and conversion of natural habitats to developed areas would be moderate, and cause habitat fragmentation, altered hydrology, and degraded habitat quality.

4.2.7 Essential Fish Habitat

4.2.7.1 Affected Environment

The Magnuson-Stevens Fishery Conservation and Management Act, which was reauthorized and amended in 1996 by the Sustainable Fisheries Act, requires the eight regional fishery management councils to describe and identify EFH in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Congress defined EFH as “those waters and substrate necessary to marine fish for spawning, breeding, feeding, or growth to maturity” (P L 94-265, as amended P L 109-479). The Magnuson-Stevens Fishery Conservation and Management Act requires the NMFS to assist the regional fishery management councils in the implementation of EFH in their respective Fishery Management Plans (FMP). The EFH descriptions and identifications for Gulf of Mexico FMPs were approved on February 8, 1999, for 26 selected species and coral complexes. Today the Gulf of Mexico Fisheries Management Council (GMFMC) manages EFH for 28 species of marine fish and invertebrates within their respective FMPs.

Much of the HSDRRS project area is surrounded by brackish estuary systems that are designated as EFH. Aquatic organisms that inhabit this highly diverse ecosystem are generally tolerant of a wide range of salinities. The landward boundary of estuarine EFH is the limit of permanent

freshwater bottom and the seaward limits are the terminus of the U.S. exclusive economic zone. EFH includes all waters and habitats or substrates within these estuarine boundaries. The habitats are water bodies where Federally managed fish, and the organisms they prey upon, live during the various stages of their life history. Specific categories of EFH include all estuarine waters and their mud, sand, shell, and rock substrate. Artificial reefs, oyster beds, and the associated biological communities, SAV, and adjacent intertidal vegetation (marshes and mangroves) are considered EFH. The EFH designation does not generally extend into the freshwater portions of rivers discharging to the estuarine system (GMFMC 1998). Vegetated areas are emphasized because of their importance to fish production and because of their vulnerability to human's activities. Marsh, oyster shell, SAV, and unvegetated bottom habitats that constitute EFH are found in the HSDRRS project area. Table 4-11 presents a list of water bodies designated as EFH located in the project area.

Table 4-11. EFH Designated Water Bodies in the Project Area

Flood Side of Levee	Protected Side of Levee
Bayou Verret	Bayou Bienvenue*
Bayou Segnette	Violet Canal
GIWW	Terre Beau Bayou
MRGO	Pirogue Bayou
IHNC	Bayou Dupre*
Lake Pontchartrain	Bushman Bayou
Lake Borgne	Bayou Sauvage*
Lake Cataouatche	Bayou LaBranche

*Portions of this water body occur on both sides of the levee

Federally Managed Fish and Shellfish EFH

EFH regulations protect the habitats of fish and shellfish managed by the GMFMC. The most common Federally managed species in the project area is shrimp. The GMFMC lists brown shrimp, white shrimp, pink shrimp, red drum, and Spanish mackerel (*Scomberomorus maculatus*) as known to exist in the estuaries near the project area. Table 4-12 presents a list of species found in the HSDRRS area that are managed by the NMFS.

Table 4-12. Federally Managed Species In and Near the Project Area

Managed Species	Life Stages	Designated EFH	Prey Species
Brown shrimp	eggs, larvae, juveniles	SAV, emergent marsh, oyster reef and sand, shell and soft bottom	some zooplankton, various fish species, polychaetes, amphipods, benthic infauna
White shrimp	eggs, larvae, adults	SAV, emergent marsh, oyster reef and sand, shell and soft bottom	phytoplankton, zooplankton, detritus, annelid worms, pericardid crustaceans, caridean shrimp, diatoms, gastropods, copepods, bryozoans, sponges, corals, filamentous algae, vascular plants
Pink shrimp	eggs, larvae, juveniles	SAV, emergent marsh, oyster reef and sand, shell and soft bottom	copepods, small mollusks, benthic diatoms, blue-green algae, filamentous green algae, vascular plant detritus, bacterial films, slime molds, yeast
Red drum	eggs, larvae, adults	SAV, emergent marsh, oyster reef and sand, shell and soft bottom	copepods, mysids, amphipods, shrimp, polychaetes, insects, small fish, isopods, bivalves, crabs, shrimp
Spanish mackerel	adult	Water column	various fish species, crustaceans, gastropods, and squid

Source: GMFMC 1998

Abundance of Federally Managed Species in HSDRRS Project Area

Spawning of shrimp occurs in offshore waters of the Gulf of Mexico. The larval populations are driven inshore by winds and currents. The various species have similar estuarine-dependent life history stages and vary seasonally in abundance. Adult white shrimp begin to appear in Lake Pontchartrain and Lake Borgne with a major peak of abundance beginning in August during the high salinity season and extending through the end of January. They are common in the spring as salinity decreases, and then begin to migrate back to the sea during June when bay salinities begin to increase. In non-vegetated areas, post-larval and juvenile white shrimp inhabit mostly muddy substrates that contain large quantities of detritus. Sub-adult white shrimp move from the estuaries to coastal areas in late August and September (GMFMC 1998).

Brown shrimp utilize the same nursery grounds as white shrimp during the juvenile growth period from the post-larval stage to the adult stage. Adult brown shrimp move offshore to reproduce. The juvenile brown shrimp population is highly abundant in Lake Pontchartrain and Lake Borgne throughout the year; however, adult brown shrimp are rarely seen all year in the estuarine habitats. Adult pink shrimp are rarely found in Lake Pontchartrain and Lake Borgne; however, juveniles are common in the region year-round (GMFMC 1998).

Adult and juvenile red drum are common in the HSDRRS project area throughout the year. Most of the population spawns offshore and then moves inshore to fertile estuarine waters. Juveniles and young adults are common in Lake Pontchartrain; however, fully grown adults prefer the higher salinities along the coast. Seagrass and coastal marsh habitats typically serve as nursery areas for juvenile red drum (NOAA 2007a).

Adult Spanish mackerel are not present in the HSDRRS project area, although juveniles have been identified in the region. It is likely that larval and post-larval fish are driven inshore by wind and currents. Table 4-13 lists the Federally managed species found in the HSDRRS project area and their relative abundance during the year.

Table 4-13. Abundance of Federally Managed Species in the HSDRRS Project Area

Species	Life Stage	Relative Abundance			
		Low Salinity (Feb-Apr)	Increasing Salinity (May-July)	High Salinity (Aug-Oct)	Decreasing Salinity (Nov-Jan)
White shrimp	Adult	Rare	Rare-Common	Common	Common
	Juvenile	Common	Abundant	Abundant	Abundant
Brown shrimp	Adult	Rare	Rare	Rare	Rare
	Juvenile	Abundant	Abundant	Abundant	Common
Pink shrimp	Adult	Rare	Rare	Rare	Rare
	Juvenile	Common	Common	Common	Common
Red drum	Adult	Common	Common	Common	Common
	Juvenile	Common	Common	Common	Common
Spanish mackerel	Adult	Not present	Not present	Not present	Not present
	Juvenile	Rare	Rare	Rare	Rare

Source: NOAA 2007

Prey Species of Federally Managed Species

Coastal wetlands provide nursery and foraging habitat that supports economically important marine fishery species such as speckled trout, southern flounder (*Paralichthys lethostigma*), Atlantic croaker, Gulf menhaden, striped mullet, and blue crab. These species, and many others, serve as prey for Federally managed fish species such as mackerels (*Scombridae* spp.), snappers (*Lutjanidae* spp.), groupers (*Serranidae* spp.), billfishes (*Xiphiidae* spp.), and sharks

(*Selachimorpha* spp.). The prey species' habitats are protected under the same Federal regulations as the habitat of the regulated species. The SAV areas are preferred by prey species. Duffy and Baltz (1998) found that fish assemblages of prey species were significantly more abundant in vegetated areas than the adjacent unvegetated areas. The GMFMC (2005) noted that mud and sand substrates, oyster reefs, and artificial reefs also provide refuge habitats for prey organisms.

EFH Structural Habitat

Designated EFH structure in the estuarine regions of the Gulf of Mexico consists of oyster reefs, SAV, wetlands, and artificial structures (GMFMC 2005). These habitats can be found in the shallow waters of Lake Pontchartrain, Lake Borgne, and other parts of the HSDRRS project area. The following sections briefly describe the variety of EFH substrate found within the water bodies in the project area.

Submerged Aquatic Vegetation (SAV)

Duffy and Baltz (1998) compared fish assemblages associated with SAV and adjacent unvegetated areas and found significantly higher ichthyofauna populations in SAV. Historically, SAV was abundant on all shores of Lake Pontchartrain; however, the total area decreased by 90 percent between 1954 and 1998 (Suttkus et al. 1954, Darnell 1961, Montz 1978, Turner et al. 1980, Burns et al. 1993, Duffy and Baltz, 1998). Shoreline modification, increased water turbidity, and macroalgal overgrowth have contributed to this decline (Cho and Poirrier 2000b). Total SAV habitat in Lake Pontchartrain was about 1,112 acres at the time of the Cho and Poirrier study. In spite of the widgeongrass increase, eelgrass continued to decline. It is not known whether the increase in widgeongrass was a short-term response to a temporary increase in water clarity caused by a severe drought or a long-term increase due to improved environmental quality (Cho and Poirrier 2000a).

Oyster Reefs

Higher saline waters enter Lake Pontchartrain from the GIWW and MRGO via the IHNC. The increase in salinity presents opportunities for oyster growth in this part of Lake Pontchartrain, while the rest of the waters adjacent to the HSDRRS project areas are absent of oyster beds due to low salinities.

Unconsolidated Marine Water Bottoms

Unconsolidated marine water bottoms occur in Lake Pontchartrain, Lake Cataouatche, and Lake Borgne, as well as some of the canals and bayous within the project area. As summarized by the GMFMC (1998), various authors have noted that sediment type is a major factor in determining the associated fish community in areas with non-vegetated bottoms. Surface sediments may affect shrimp and fish distributions directly in terms of feeding and burrowing activities, or indirectly through food availability, water column turbidity, and related factors. The faunal assemblages of the central and western Gulf of Mexico rely on the terrigenous mud and sands of the area as opposed to the calcareous sediments of the eastern Gulf of Mexico. Shrimp distribution closely matches sediment distribution; white and brown shrimp occupy the terrigenous muds, while pink shrimp occur on calcareous sediments. Similar sediment associated distribution has also been observed for many demersal fish (GMFMC 1998).

Artificial Reefs

The demolition of the old I-10 Twin Spans Bridge includes the use of that material for the creation of artificial reefs. A total of three reef sections will be created in Lake Pontchartrain following the completion of demolition in 2012.

In early 2000 the Lake Pontchartrain Artificial Reef Working Group, a partnership of the LPBF, sportsmen, private groups, and local and state agencies, began to spearhead the creation of artificial reefs in Lake Pontchartrain. From 2001 to 2009, five artificial reef sites were developed near the southern shore of Lake Pontchartrain and donated by the Louisiana Department of Wildlife and Fisheries (LDWF). One of the artificial reef sites is located just offshore of the Citrus Lakefront Levee. This reef is a series of crushed limestone rubble mounds spread over a 2-acre site creating a large area of varied relief (LPBF 2006). These reefs are located as follows:

- H1 30 5.028° 90 12.096° NAD83
- H3 30 5.034° 90 12.582° NAD83
- H4 30 5.274° 90 12.336° NAD83
- Orleans 30 7.441° 90 4.695° NAD83
- St. Charles 30 8.085° 90 19.038° WGS84

(LPBF 2009)

Rangia Clams

Rangia clams are abundant in Lake Pontchartrain; however, low population densities have been recently documented, presumably due to higher salinity levels in the lake waters adjacent to the HSDRRS project corridor (Poirrier et al. 2009). The clams are filter feeders and improve the water quality in the lake. The organisms sift out suspended clays and silts, particulate carbon, and nitrogenous wastes. They are prey species for Atlantic croaker, white shrimp (juvenile *rangia* clams), spotted seatrout, and many other lake predators. The *rangia* clam hard substrata provide surface area for a wide range of benthic copepods, polychaetes, benthic algae, mollusks, bryozoans, amphipods, and other zooplankton to feed and reproduce. Ichthyoplankton feed over the reefs. The *rangia* clam is a keystone species in Lake Pontchartrain. They suffer mortality due to a reduction in DO associated with dredging, severe weather events, high salinity levels and stratification, and non-point source pollution (Poirrier et al. 2009). Hurricane Katrina resulted in low DO in the bottom layer of Lake Pontchartrain, which further reduced the abundance of *rangia* clams in the lake. *Rangia* clams and other community dominants were lost from 50 percent of the lake bottom, and have been slow to recover (Poirrier and Spalding 2007).

4.2.7.2 Impacts of HSDRRS

4.2.7.2.1 HSDRRS 2011 Impacts

A comprehensive discussion of impacts on EFH resulting from specific construction activities; associated dredge, fill, and material stockpiling activities; water body displacement; and/or hydrologic modifications of waterways and ecosystems within the HSDRRS area is detailed below. The HSDRRS impacts on EFH are further discussed within each of the nine separate sub-basins located on the east (LPV) and west (WBV) banks of the Mississippi River within the HSDRRS.

Acreage assessments utilized in the impact discussions were based on the final CARs provided by USFWS, and the Final IER documents and their corresponding Decision Record, when appropriate. Mitigation for impacts on EFH is described further in section 5.0.

Impacts on EFH occurred with the loss of open water aquatic and brackish habitats. Interspersed open water within and adjacent to marsh was assessed along with marsh impacts using the WVA Methodology. Compensatory mitigation included the lost functions of those aquatic habitats. Although open water areas with tidal influences may be productive for estuarine fisheries, there continue to be annual gains in various open water habitats due to the relatively high rates of wetlands loss.

A quantitative summary of the adverse impacts on EFH associated with the HSDRRS activities is listed for each sub-basin in table 4-14. Some work presented in the IERs was not performed for the HSDRRS construction and may or may not be performed in the future; as such, although noted here in the CED, the final compensatory mitigation values are subject to change. In order to minimize impacts on EFH, the USACE implemented mitigation efforts that are similar to those that were implemented for fisheries impacts, and which are discussed in section 5.0. Final compensatory mitigation values will be addressed in the HSDRRS Mitigation IERs; however, the most current values can be found in appendix N.

St. Charles Sub-basin

The forested wetland areas adjacent to the project area are hydrologically connected to the EFH of the Lake Pontchartrain Estuary. However, the wetlands areas (primarily cypress swamp) that were affected by the HSDRRS action were not likely to be suitable habitat for any of the Lake Pontchartrain estuary-managed species (shrimp and red drum), and impacts from the project on EFH of Lake Pontchartrain were unlikely. Therefore, EFH was not evaluated further as a potentially impacted resource (IER #1).

Jefferson East Bank Sub-basin

EFH impact discussions the Jefferson East Bank sub-basin were based on the HSDRRS projects captured in IERs #2, #3, IER Supplemental #2, IER Supplemental #3, and IER Supplemental #3.a and permanent impacts on EFH were moderate. Construction of the floodwall along the new alignment for LPV-03a and -03c impacted 3 acres of aquatic habitat (open water and water bottom) and resulted in mortality of the immobile and less motile species in the filled area. Approximately 34 acres of high-quality wetlands habitat were impacted by the floodwall realignment near the airport for this HSDRRS action. These wetlands are designated EFH (IER Supplemental #2). Temporary dredging impacts for access impacted up to 59 acres of soft bottom EFH. This access canal was filled upon completion of the project.

Impacts from construction activities on sessile benthic populations, such as rangia clams, were short-term, lasting approximately 2 to 2.5 years in duration, with turbidity effects potentially lasting up to several months after construction completion. The existing aquatic and wetlands habitat destroyed under the HSDRRS projects were replaced by mostly hard rock surfaces that are suitable for colonization by periphyton and other sessile organisms. This new habitat provided protective cover for various species of shellfish and finfish, providing a more productive aquatic community.

Construction activities related to LPV-13 occurred entirely within the existing alignment and were set back from the shoreline of Lake Pontchartrain. No EFH was permanently impacted by these construction activities.

A total of 61 acres of permanent impacts on lake bottom along LPV-00, -01, -02, -19, and -20 occurred from the placement of wave attenuation berms and foreshore protection. Approximately 200 acres of temporary impacts were associated with the dredging of access canals and placement of the foreshore protection. The dredging temporarily displaced and possibly destroyed the benthic organisms (including clams). Turbidity resulting from dredging and construction was temporary in nature. Most motile species likely avoided the areas temporarily impacted by dredging, as well as shoreline areas that were permanently lost due to filling. Impacts on less motile benthic species from these activities likely occurred, but were short-term, approximately 1.5 years to 2.5 years in duration, with effects lasting until the areas stabilized (IER Supplemental #3.a).

Table 4-14. The HSDRRS Activity¹ and Impacts on EFH*

Sub-basin	IER*** #	HSDRRS Activity	EFH	Summary of Impact
St. Charles	1, S 1	The St. Charles sub-basin and associated IERs are not located near EFH; therefore, construction activities related to the HSDRRS activity did not impact EFH.		
Jefferson East Bank	2, S 2, 3, S 3.a	Dredging activities, levee expansion, and construction stormwater runoff	SAV, emergent marsh, unconsolidated water bottom, shell and soft bottom	<ul style="list-style-type: none"> • Levee realignment permanently impacted 100 acres of lake bottom and brackish marsh. • Dredging and materials stockpiling permanently impacted 61 acres of lake bottom and another 200 acres of lake bottom experienced temporary minor impacts from dredging and material stockpiling. • Temporary impacts on EFH occurred from construction activities.
Orleans East Bank	4, 5, 27	Construction stormwater runoff, levee expansion	SAV, emergent marsh, unconsolidated water bottom, shell and soft bottom	<ul style="list-style-type: none"> • Breakwater construction would permanently impact 3.3 acres of lake bottom and brackish marsh. • Temporary impacts on EFH occurred from construction activities.
New Orleans East	6, S 6, 7, S 7 11 Tier 2 Borgne, 11 S Tier 2 Borgne, 11 Tier 2 Pontchartrain, 18, 19, 25, 29	Hydro-modification, levee expansion, dredging activities, construction stormwater runoff, impervious surfaces	SAV, Rangia clams, oyster reefs, emergent marsh, unconsolidated water bottom, shell and soft bottom	<ul style="list-style-type: none"> • Levee realignment and Borgne barrier permanently impacted 374 acres of lake bottom and brackish marsh. • Dredging and materials stockpiling temporarily impacted 178 acres** of lake bottom. • Temporary impacts on EFH occurred from construction activities.
Chalmette Loop	8, 9, 10, 18, 19, 28, 30	Construction stormwater runoff and levee expansion	Emergent marsh, unconsolidated water bottom, shell and soft bottom	<ul style="list-style-type: none"> • Levee realignment permanently impacted 195.3 acres of water bottom and brackish marsh. • Temporary impacts on EFH occurred from construction activities.

Table 4-14, continued

Sub-basin	IER*** #	HSDRRS Activity	EFH	Summary of Impact
Belle Chasse	13, 18, 22, 30	The Belle Chasse sub-basin and associated IERs are not located near EFH; therefore, construction activities related to the HSDRRS activity did not impact EFH.		
Gretna-Algiers	12, 12 S	The Gretna-Algiers sub-basin and associated IERs are not located near EFH; therefore, construction activities related to the HSDRRS activity did not impact EFH.		
Harvey-Westwego	14, S 14.a	The Harvey-Westwego sub-basin and associated IERs are not located near EFH; therefore, construction activities related to the HSDRRS activity did not impact EFH.		
Lake Cataouatche	15, 16, S 16.a, 17, 18, 22, 25, 26, 28	The Lake Cataouatche sub-basin and associated IERs are not located near EFH; therefore, construction activities related to the HSDRRS activity did not impact EFH.		
Areas Outside of the HSDRRS Sub-basins	18, 19, 22, 23, 25, 26, 28, 29, 30, 31, 32	HSDRRS borrow areas outside of the sub-basins are not located near EFH; therefore, activities related to these IERs did not impact EFH.		

* The impact values shown are from the final IERs – final compensatory mitigation values are shown in appendix N.

** IERs #6 and 7 dredging work (178 acres of impacts) did not occur for the HSDRRS 2011 but would potentially occur with the HSDRRS 2057 work.

***S – Supplemental

¹ Based on NEPA Alternative Arrangement documents completed by November 15, 2010.

EFH that was destroyed during construction was replaced by earthen fill and a rocky foreshore suitable for colonization by periphyton and sessile organisms. Thus, the construction created new habitat that was uncommon in Lake Pontchartrain and potentially more productive than the more common mud bottoms.

Additional lake bottom (3.5 acres) was impacted at LPV-09 and LPV-12 with the placement of additional rock armoring. The EFH removed as a result of this additional armoring was a very small area relative to the extent of similar habitat within Lake Pontchartrain (IER Supplemental #3.a).

Temporary impacts on lake bottom, totaling 10.5 acres, were associated with dredging for barge access and stockpiling along LPV-17. Turbidity curtains were used to minimize impacts on water quality and marine organisms during construction. All materials were removed during creation of the access channels and returned to their original location upon project completion. The disturbance and loss of lake bottom from construction activities affected EFH through the direct loss of fish habitat. Impacts on EFH as a result of the Jefferson East Bank sub-basin projects were permanent and moderate.

Orleans East Bank Sub-basin

Much of the construction activity occurred on developed land within the Orleans East Bank sub-basin and did not directly impact EFH (IER #27). Permanent minor impacts on EFH occurred from fill of open water and increased impermeable surfaces. For LPV-101, LPV-103, and LPV-104, impacts on EFH were indirect and temporary due to construction-related increased turbidity associated with stormwater runoff from staging areas. Once construction was completed, it was likely that EFH returned to pre-construction abundance. No impacts on EFH occurred with construction along LPV-102 (IER #4).

Temporary impacts on water turbidity, DO, and BOD during construction and storm events had the potential to temporarily displace fish species. Approximately 3.3 acres of open water/mud bottom habitat in Lake Pontchartrain would be lost with the construction of breakwaters at the mouth of the 17th Street and Orleans Avenue canals (IER #5). However, these breakwaters potentially would result in a beneficial indirect impact by providing substrate for sessile organisms that provide food for other aquatic species. Therefore, impacts on EFH as a result of the Orleans East Bank sub-basin projects were negligible.

New Orleans East Sub-basin

The construction of a new floodgate, floodwalls, and levee along LPV-105, LPV-106, and LPV-107 resulted in temporary increases in suspended sediments discharged to adjacent water bodies during construction activities and minor permanent impacts. Once construction was completed, these temporary impacts were eliminated. The artificial reef located 3 miles offshore of the project area was not impacted by construction activities (IER #6).

Along LPV-109, 101 acres of wetlands, mostly intertidal marsh, on the flood side of the levee were permanently lost. The increase in the levee footprint along LPV-111 directly impacted EFH through the loss of approximately 5 acres of brackish marsh on the flood side of LPV-111. Dewatering of the discharge basin at Pump Station No. 15 temporarily impacted 0.4 acre of EFH. Several of the less motile Federally managed species occurring in the GIWW, such as shrimp, were directly impacted by dewatering activities through mortality. Other more motile species were likely not directly affected; however, their habitat, such as water bottom and marsh interface, and some of their prey species had the potential to be directly affected by increased turbidity during dewatering activities (IER #7).

The temporary increase in suspended solids due to dredging potentially had temporary impacts on SAV due to the decrease in light penetration. In addition, dredging can suspend fertilizers and pesticides associated with sediments. These elements are detrimental to the managed species, as well as their prey species. Dredging disturbs benthic organisms such as rangia clams by direct removal or by burying them with sediments. Due to the high salinities in the project area, the rangia clam populations along this project reach were small and impacts were minor.

The additional raising and relocation of pump stations at LPV-109 and LPV-111, along with provisions for temporary pumps during construction, resulted in direct impacts on wetlands and waters of the U.S., which indirectly impacted EFH by further reducing the availability of habitat for fish prey items, potential spawning sites, and areas for juvenile fish to hide from predators (IER Supplemental #7). USFWS determined that the levee construction and upgrades associated with LPV-109 and LPV-111 levee reaches directly impacted an additional 119 acres of fresh/intermediate marsh and 126 acres of brackish marsh (EFH) (FWCAR-IER #7).

Construction and installation of a sector gate and two vertical lift gates in the IHNC resulted in temporary impacts on 2.5 acres of open water in the vicinity of the project area during construction, and 6.9 acres of open water and water bottoms (EFH) in the IHNC were permanently lost to the new structures and associated ROW (IER #11 Tier 2 Pontchartrain). Construction resulted in the loss of deep-water habitat; however, there were potential beneficial impacts related to improved DO concentrations in the scour hole. Permanent impacts occurred due to changes in hydrology (salinity, DO, and velocity) and potential negative impacts on larval fish recruitment due to the Borgne barrier and the GIWW gate. USACE's ERDC predicted bottom DO levels will fall below the 4.0 mg/l standard with the HSDRRS structures in place (USACE 2008n); however, DO levels are historically seasonally low in the IHNC, GIWW, and MRGO proximate to the structures. ERDC further predicted that the salinity of ambient waters will be several parts per thousand lower with the HSDRRS structures in place. Salinity and DO are being monitored by CEMVN, and those data are presented in appendix G. Final results of the monitoring effort are anticipated to be completed in 2013.

The Borgne barrier crossed the GIWW, Bayou Bienvenue, the deauthorized MRGO, and the Golden Triangle marsh. Direct impacts on EFH occurred due to changes in estuarine substrate, including sand/shell, mud bottom, and open water within the footprints of the floodwall and other structures. Approximately 125.3 acres of wetlands and open water (bottoms and water surface area) were permanently impacted by the construction of the floodwall/gated system. However, beneficial use of the project-related dredge material could enhance 205 acres of open water east of the site (IER #11 Tier 2 Borgne). Analysis of pre- and post-placement aerial photography showed a net gain of approximately 14 acres of emergent marsh within the beneficial use area.

Construction of the Borgne barrier across the Golden Triangle marsh and associated waterways adversely impacted EFH by fragmentation of the emergent marsh habitat and altering natural hydrologic sheet flow, sedimentation processes, and recruitment and migration of important estuarine aquatic species needed to sustain the fisheries food web. Incidental mortality of some fishes and aquatic/benthic species likely occurred from burial during dredging and placement of disposal material. However, four 48-inch culverts within the Bayou Bienvenue cofferdam were installed during construction of the gate structure to allow for hydrologic exchange. Most of the more motile Federally managed species were expected to relocate until construction activities were complete. USFWS determined that the floodwall and other structures directly impacted 77 acres of fresh/intermediate marsh and 45 acres of brackish marsh (FWCAR-IER #11).

As described previously in section 4.2.5.2.1, hydrologic modeling predicted that surface velocities in the MRGO and the GIWW were expected to have minor increases, and those velocity increases were restricted to areas within and near the new structures (USACE 2010d).

During very infrequent events, such as the combination of a strong spring tide and a frontal passage, velocities in Bayou Bienvenue at the new structure are estimated to be greater than 2.6 ft/s, which can inhibit fish passage while causing greater adverse impacts on less motile species. However, these velocities would rarely occur in the structure, have been determined to be manageable for fish greater than 50 millimeters in length (USACE 2008u), and have only a minor long-term impact on EFH. Prior to HSDRRS construction, in tidal passes such as the Rigolets, Chef Menteur, or Seabrook, velocities greater than 2.6 ft/second regularly occurred during tidal exchange (USACE 2010l, USACE 2008u, USACE 2010g). Further, a particle transport model that analyzed the movement of particles that were assigned larval fish behavior characteristics determined that the completion of construction of the Seabrook gate complex and Borgne barrier would have a minor impact on larval fish recruitment in Lake Pontchartrain (USACE 2010l).

Habitat loss, hydro-modifications, and water quality impacts from construction activities affected local and regional fisheries (and prey) species through the direct loss of EFH, modification of fish navigation, and changes to the salinity profiles of the waterways. These impacts on EFH as a result of the New Orleans East sub-basin projects were moderate and permanent.

Chalmette Loop Sub-basin

Moderate permanent impacts occurred on EFH; EFH impact discussions within the Chalmette Loop sub-basin were based on the HSDRRS projects captured in IERs #8, #9, and #10. Construction of a new flood control structure with steel sector gates and floodwall tie-ins, constructed on the flood side of and adjacent to the existing structure, resulted in impacts on EFH within the Chalmette Loop sub-basin. Up to 2 acres of aquatic habitat in Bayou Dupre was disturbed during construction, and approximately 0.3 acre was permanently occupied post-construction. During construction, reduced tidal exchanges likely occurred over 40,000 acres of marsh and open water habitat (FWCAR-IER #8). Alterations in water quality from sediment loading associated with construction adversely impacts EFH by lowering DO and increasing water temperature. Connectivity was maintained during cofferdam construction and use between Bayou Dupre and the Central Wetlands Area, and managed species were not expected to be adversely impacted (IER #8).

Construction within the Caernarvon Canal resulted in up to 0.3 acre of EFH (canal bottom) lost post-construction (IER #9).

Additional construction within the Chalmette Loop sub-basin included a T-wall on top of existing levee reaches (LPV-145, 146, and 148) and the Bayou Road floodgate (LPV-147). These construction projects resulted in an estimated loss of 42 acres of EFH (open water habitat) (IER #10).

Indirect impacts on EFH and EFH species likely occurred during construction due to changes in water characteristics. Stormwater runoff potentially resulted in increased nutrient loads or sedimentation to aquatic systems, depending on the types and concentrations of constituents associated with the suspended materials. In addition, resuspension of soil particles increased turbidity, resulting in impacts on both sessile and motile aquatic species. Settling of soil particles over existing bottom sediments (if significant) potentially resulted in minor loss of habitat for sessile species of invertebrates and plants and also disrupted oxygen transport mechanisms for many species. Effects, such as those from construction activities, were minimized by the use of BMPs to control sediment transport.

Construction activities resulted in the loss of EFH, the majority of which was open water habitat. This habitat is abundant in the project area, and these impacts were minor, but permanent, as a result of the Chalmette Loop sub-basin projects.

Belle Chasse, Gretna-Algiers, Harvey-Westwego, and Lake Cataouatche Sub-basins

No EFH was impacted by construction activities within these sub-basins.

Impacts from Borrow Within and Outside the HSDRRS Sub-basin Boundaries

A variety of government-furnished and contractor-furnished borrow sites have been utilized from within and outside of the HSDRRS sub-basin boundaries. Impacts on EFH or managed species would not occur with the use of these borrow sites because they are not located in intertidal or estuarine areas.

4.2.7.2.2 HSDRRS 2057 Impacts

Short-term construction-related EFH impacts from future construction would include damage to SAV, adjacent marsh vegetation utilized as EFH, disturbance to sediments, and increased turbidity and sedimentation in and adjacent to EFH. After construction, the habitats would stabilize, allowing for suspended sediments to settle and vegetation to recolonize the area, and permanent impacts on EFH would be minor. Construction-related impacts would also affect other habitats utilized by fisheries, including lake bottoms, canal bottoms, drainage waterways, and open water. Direct impacts from dredging would be minor and include increased turbidity during dredging, disruption of water bottoms from access channels and material stockpiles, and destruction of SAV.

The removal of EFH associated with expanded ROW construction, if necessary, for HSDRRS levee lifts would be detrimental to managed species that depend on open water, edge, and shallow habitat for survival. Impacts would likely result from increased turbidity on the wetlands and open water areas surrounding the project area. However, it is assumed that resident motile organisms would attempt to avoid construction activities and seek refuge in adjacent and suitable habitat. Likewise, impacts on EFH from the expanded ROW construction activities would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) as described in the project's SWPPP.

The future impacts from foreshore protection detailed in IERs #6 and #7 did not occur, as the foreshore protection was not performed for completed HSDRRS construction but may be done in the future (through year 2057). Construction activities associated with raising foreshore protection along LPV-105, LPV-106, and LPV-107 would temporarily impact approximately 61.1 acres of lake bottom for construction of temporary access channels. These channels would be refilled to their prior grade following the completion of the project. This impact would cause a temporary loss of forage habitat for finfish and shrimp, and permanently impact 4 acres of marsh habitat, causing a permanent loss of EFH (FWCAR-IER #6).

Dredging of access channels and placement of foreshore protection along LPV-108 in Lake Pontchartrain would disturb 118.1 acres of lake bottom and permanently impact 7.2 acres of shallow lake bottom habitat (IER #7). Several of the less motile Federally managed species occurring in Lake Pontchartrain, such as shrimp, would have the potential to be directly impacted by dredging activities through the loss of individuals. Dredging activities frequently result in anoxic conditions around a site; however, some of the managed species, such as red drum, are capable of navigating away from these areas. These species have the potential to be impacted by the loss of habitat, such as SAV, as some of their prey species would potentially not be motile enough to avoid direct impacts. Temporary access canals would be filled in to previously existing grade upon completion of the project. This would allow for recolonization by SAV and benthic organisms.

4.2.7.3 Cumulative Impacts

4.2.7.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Cumulatively, valuable aquatic shelter and foraging habitat for managed species and their prey species have and will be adversely impacted due to the direct loss of EFH as a result of the HSDRRS. The direct cumulative HSDRRS impacts on EFH are minor due to the abundance of EFH in the region, and are associated with the actual construction activities; the associated dredge, fill, and material stockpiling activities; water body displacement; and hydrologic modifications of waterways and ecosystems. Floodgate operations could alter the hydrology within marshes, adversely impacting plant health and thereby reducing available fish habitat, forage, and nursery habitat. The indirect cumulative HSDRRS impacts on EFH include adverse effects on fish migratory movements; active/passive transport of fish eggs and larvae; nursery habitat and recruitment of fish larvae and juveniles; water characteristics and organism access to abiotic water quality habitats (e.g., temperature, salinity, turbidity, and DO); organism access to biotic water quality habitats (e.g., protection from predators and food availability); and hydrology and water velocity.

The cumulative construction activities are projected to cause sedimentation and contamination of waterways from stormwater runoff during rain events. Alterations in water quality from sediment loading adversely impact fisheries by lowering DO and increasing water temperature. Additional adverse impacts on fish and other aquatic organisms from sediment suspension and siltation in waters adjacent to the HSDRRS area include clogged gills, reduced growth rates, and disruption of egg and larval development (USEPA 2003).

The beneficial use of dredged material for wetlands enhancement in JLNHPP could eventually offset some of the damages to EFH from HSDRRS construction near JLNHPP. Construction-related damages to quality EFH associated with the HSDRRS would be fully mitigated through formal mitigation planning.

4.2.7.3.2 Cumulative Impacts of Present and Future Regional Actions

Impacts of other ongoing and future regional actions are similar in many of the sub-basins and parishes affected by the HSDRRS.

Storm Damage Reconstruction

Present and future regional storm damage reconstruction projects would have little to no direct effect on EFH because most projects would be limited to disturbed areas. Indirect adverse impacts from reconstruction project activities could cause sedimentation and contamination of waterways from stormwater runoff during rain events. Alterations in water quality from sediment loading could adversely impact EFH by lowering DO and increasing water temperature. Additional adverse impacts on managed species and other aquatic organisms from alterations in water quality (sediment suspension, siltation, and turbidity) in waters adjacent to the regional storm damage reconstruction projects would include clogged gills, reduced growth rates, and disruption of egg and larval development (USEPA 2003). Potential impacts on EFH from the regional storm damage reconstruction projects would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport). However, present and future regional storm damage reconstruction projects are not anticipated to significantly contribute to the cumulative impacts on EFH, and are thus considered negligible.

Redevelopment

Large-scale development projects along the shore of Lake Pontchartrain would have a permanent impact on EFH when aquatic features are incorporated into the development plans (e.g., docks, marinas). Local and regional zoning regulations and permitting requirements may serve to minimize adverse EFH impacts. Impacts on EFH could potentially occur from an increase in

impervious land use that would result in increased water quality degradation from non-point source pollutants in the local water bodies. Present and future regional redevelopment projects are not anticipated to significantly contribute to the cumulative impacts on EFH, and thus are considered negligible.

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects aim to mimic or restore natural hydrology and sediment processes that build and maintain wetland habitats. Restoration projects improve wetlands quality by collecting and filtering sediment and nutrients and by reducing soil erosion. In addition, coastal and wetlands restoration projects would increase plant biodiversity and provide improved fish habitat. Coastal and wetlands restoration projects would provide cumulative benefits to EFH and fisheries in southeast Louisiana through the creation of habitat and forage areas. The State of Louisiana has initiated a series of programs and projects designed to offset the loss of wetlands and EFH, including projects previously described in the Fisheries Resources section (section 4.2.5.3.2).

Flood Risk Reduction Projects

Flood risk reduction projects in many of the HSDRRS sub-basins would contribute to additional loss of EFH and other fish habitat through the filling of wetlands due to levee and floodwall expansion. Some projects may result in long-term beneficial impacts, such as reducing the likelihood of storm surges converting marsh into open water. Storms can erode fragile, floating marshes, and storm surges can push saltwater into fresh marshes, killing the vegetation and thus converting marsh habitat into open water. In general, the loss of EFH, wetlands, and other fish habitats due to the HSDRRS and other present and future flood risk reduction projects is a small fraction of the wetlands habitat in Louisiana, but any permanent loss is considered significant. All direct and indirect impacts on EFH from USACE flood risk reduction projects would be minimized using BMPs (reducing potential for indirect adverse effects from soil erosion, runoff, and sediment transport) as described in the project's SWPPP. The loss of wetlands and open water habitats from specific flood risk reduction project have been described in previous resources section, and these habitat losses constitute a loss of EFH.

Based on historical anthropogenic activities and land use trends in Louisiana, it is assumed that future flood risk reduction projects would have a cumulative adverse effect on water quality, which would adversely impact EFH. Cumulatively, all flood risk reduction projects would contribute to wetlands and fish habitat loss and would adversely impact EFH, migration, and spawning.

Once flood risk reduction infrastructure is in place, additional benefits for EFH and fisheries from improved hydrology and reduced erosion would also occur. Long-term effects of flood risk reduction infrastructure would slow the erosion of valuable habitat by reducing the potential for marsh fragmentation due to high-energy storm surge. Storm risk reduction infrastructure would provide for improved control of the release of floodwaters after storm events regionally. Flood risk reduction projects in Lake Pontchartrain and Breton Sound would result in lower salinity marshes, which could provide a long-term benefit to fisheries, as a higher biodiversity of species may be able to thrive in the lower salinity environment.

Wetlands and open water loss, hydro-modifications, and water quality impacts from construction activities would affect local and regional fisheries (and prey) species through the direct loss of fish habitat, modification of fish navigation, and overall degraded habitat water quality. The cumulative impacts on EFH resulting from the present and future regional flood risk reduction projects would be considered moderate.

Transportation

Other present and future projects in the area include repairs to highway and road infrastructure and new road and highway alignments, including widening. These projects may have temporary impacts, but should have little to no cumulative effects on EFH due to the fact that most of the projects are being constructed in previously disturbed areas. However, if unavoidable impacts should arise, permitting activities, and implementation of mitigation measures (avoidance, minimization, and compensatory mitigation) would minimize long-term cumulative impacts.

- Florida Avenue Bridge over IHNC – This project would impact EFH through the loss of 1.99 acres of wetlands and 49.45 acres of open water habitat, of which 1.28 acres are within the Florida Walk Canal. Impacts on wetlands would be negligible, because the roadway would be elevated and no changes to present hydrological conditions are planned. Wetlands vegetation would reestablish along and under the bridge once construction is complete.
- I-10 Twin Span Bridge over Lake Pontchartrain – This project would impact EFH habitat through the loss of 4.6 acres of wetlands, 3.7 acres of estuarine intertidal scrub/shrub brackish marsh on the south shore in Orleans Parish, and 0.9 acre of freshwater forest scrub/shrub marsh on the north shore in St. Tammany Parish (FHWA 2006).
- I-49 Construction – A total of 578.9 acres of wetlands, including non-jurisdictional BLH, cypress/tupelo swamp, wet pasture, marsh, and scrub/shrub habitat, some of which is EFH, would be impacted by the development of I-49. Impacts would be on hydrology (e.g., leveed, pumped, or artificially constricted) and vegetation (e.g., logged or cleared). Elevated roadways would shade wetlands areas and would not support trees. The construction of I-49 would generate typical roadway pollutants, which could flow into drainage ways. Construction could also result in increased turbidity in local waters (LADOTD 2007).

Loss of wetlands and open water, hydro-modifications, and water quality impacts from construction activities would affect local and regional fisheries (and prey) through the direct loss of fish habitat, modification of fish navigation, and overall degraded habitat water quality. The cumulative impacts on EFH resulting from the present and future regional flood risk reduction projects would be moderate.

4.2.7.3.3 Summary of All Cumulative Impacts for EFH

The combination of the HSDRRS and other regional projects (e.g., storm damage reconstruction flood risk reduction projects and redevelopment, and transportation) would contribute to cumulative loss of EFH in the project area. Regional projects would adversely impact EFH by causing direct habitat loss through the filling of waterways and marshes and the dredging of water bottoms.

Indirect cumulative impacts include alterations of habitats and hydrology, which could result in changes in salinity and nutrient loads in EFH leading to further degradation of EFH. Past, present, and future flood risk reduction projects and other regional projects occurring near EFH would cause damage to EFH (including SAV), adjacent wetlands vegetation, disturbance of fisheries and sediments, and would increase turbidity and sedimentation in the adjacent aquatic habitat and drainage canals.

Risk reduction projects directly alter existing shoreline habitat and hydrologically impact marshes by impacting the natural processes of erosion, subsidence, and saltwater intrusion. The historic construction of flood risk reduction projects in southeast Louisiana is responsible for limiting water flow between the protected side of the levee and the flood side of the levee,

altering freshwater and sediment input into estuaries, and contributing to wetland fragmentation and loss. Future flood and storm risk reduction projects cumulatively add to these impacts on EFH. Large-scale coastal and wetlands restoration projects are anticipated to restore these habitats in the future, and will offset some of these historic losses of EFH. However, the cumulative impacts of flood risk reduction projects, including HSDRRS, on EFH are moderate.

4.2.8 Threatened and Endangered Species

4.2.8.1 Affected Environment

The Endangered Species Act (ESA) of 1973 (16 USC § 1531, as amended) requires that a discretionary Federal action not put into jeopardy the continued existence of a listed species or not destroy or adversely modify their critical habitat. The USFWS maintains and monitors a list of non-marine species considered to be threatened with extinction or in danger of becoming extinct. The NMFS maintains and monitors the list for marine mammals and some anadromous fishes. NMFS also has jurisdiction over species listed as depleted under the Marine Mammal Protection Act (MMPA) of 1972. All Federal agencies are required to use their authorities to further the purposes of the ESA.

The ESA also calls for the conservation of what is termed critical habitat – the areas of land, water, and air space that an endangered species needs for survival. Critical habitat also includes such things as food and water, breeding sites, cover or shelter, and sufficient habitat area to provide for normal population growth and behavior. One of the primary threats to many species is the destruction or modification of essential habitat by uncontrolled land and water development.

4.2.8.1.1 Existing Conditions

The USACE coordinated with USFWS and NMFS during the preparation of each IER and IER Supplemental to identify protected species that had the potential to occur within the sub-basin or parish. Table 4-15 provides a list of species protected by the ESA and MMPA, by parish/county, and a brief description of their preferred habitat. The brown pelican was recently delisted by the USFWS.

The piping plover (*Charadrius melodus*) and pallid sturgeon (*Scaphirhynchus albus*) are known to occur within the project region, but they are not expected to occur within the area of potential effect of any HSDRRS projects. Descriptions of threatened and endangered species that could potentially occur in the project area are briefly described in the following paragraphs.

West Indian Manatee

The West Indian manatee is Federally listed and state-listed as endangered and also is protected under the MMPA, under which it is considered depleted (USFWS 2001). Critical habitat for the manatee has not been designated in Louisiana (USFWS 1977). The manatee is a large gray or brown aquatic mammal that can reach a length of 13 ft and a weight of over 2,200 pounds. It occurs in both freshwater and saltwater habitats within tropical and subtropical regions and includes two subspecies, the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). The primary human-related threats to the manatee include watercraft-related strikes (impacts and/or propeller strikes), crushing and/or entrapment in water control structures (floodgates, navigation locks), and entanglement in fishing gear (discarded fishing line, crab traps) (USFWS 2007b). The Florida manatee can occur throughout the coastal regions of the southeastern U.S. and could travel greater distances during warmer months. It has been sighted as far north as Massachusetts and as far west as Texas. However, the manatee is a subtropical species with little tolerance for cold, and it returns to and remains in the vicinity of warm-water sites in peninsular Florida during the winter (USFWS 2007b).

Table 4-15. Threatened and Endangered Species with the Potential to Occur in the Project Area

Species	Federal Status	Habitat	Parish of Occurrence	Potential to Occur in Project Area
West Indian manatee <i>Trichechus manatus</i>	E	Open water	All	Yes, in Lakes Pontchartrain and Borgne, Bayou Dupre, Bayou Bienvenue, GIWW, and IHNC
Leatherback sea turtle <i>Dermochelys coriacea</i>	E	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	Jefferson Plaquemines	Yes, in Lakes Pontchartrain and Borgne, and MRGO
Loggerhead sea turtle <i>Caretta caretta</i>	T	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	Jefferson Plaquemines St. Bernard	Yes, in Lakes Pontchartrain and Borgne, and MRGO
Kemp's ridley sea turtle <i>Lepidochelys kempii</i>	E	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	Jefferson Plaquemines	Yes, in Lakes Pontchartrain and Borgne, and MRGO
Green sea turtle <i>Chelonia mydas</i>	T	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	Jefferson Plaquemines	Yes, in Lakes Pontchartrain and Borgne, and MRGO
Hawksbill sea turtle <i>Eretmochelys imbricata</i>	E	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	Jefferson Plaquemines St. Charles	Yes, in Lakes Pontchartrain and Borgne, and MRGO
Gulf sturgeon <i>Acipenser oxyrinchus desotoi</i>	T	Inhabits coastal rivers from Louisiana to Florida during the warmer months and overwintering in estuaries, bays, and the Gulf of Mexico	Jefferson Plaquemines St. Bernard Orleans	Yes, in Lakes Pontchartrain and Borgne, IHNC, and GIWW

E= Endangered; T= Threatened; T/CH= Threatened with critical habitat. USFWS 2009a, USFWS 2009b, LDWF 2008

The manatee is not a year-round resident in Louisiana, but it could migrate to Louisiana waters during warmer months. Manatees prefer access to natural springs or man-made warm waters with dense beds of submerged aquatic or floating vegetation. Manatees also forage in shallow grass beds that are adjacent to deeper channels, or seek out quiet areas in canals, creeks, lagoons, or rivers, using deeper channels as migratory routes (USFWS 1999). There have been 110 reported sightings of manatees in Louisiana since 1975 (LDWF 2005). Sightings in Louisiana, which have been uncommon and sporadic, have included occurrences in Lake Pontchartrain and surrounding water bodies. Between 1997 and 2000, 16 manatee sightings were reported in the Lake Pontchartrain area with a general increase in the number of manatees per sighting (Abadie et al. 2000). Sightings of the manatee in the Lake Pontchartrain Basin have increased in recent years, and in late July 2005, 20 to 30 manatees were observed in the lake during aerial surveys (Powell and Taylor 2005).

Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is Federally listed as threatened throughout its range and is state-listed as threatened in Louisiana. The Gulf sturgeon supported an important commercial fishing industry during the late 19th and early 20th centuries. A minor commercial fishery was reported to exist for Gulf sturgeon in Lake Pontchartrain and its tributaries during the late 1960s (USFWS and NMFS 2003). Throughout most of the 20th century, Gulf sturgeon suffered population declines due to overfishing, habitat loss, water quality deterioration, and barriers to historic migration routes and spawning areas (dams). In 1991, the Gulf sturgeon was listed as a threatened species under the ESA. The present range of the species extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida (USFWS and NMFS 2003).

The Gulf sturgeon is an anadromous fish that migrates from saltwater into large coastal rivers to spawn and spend the warm months. Subadults and adults typically spend the 3 to 4 coolest months in estuaries or Gulf of Mexico waters before migrating into rivers as temperatures increase (USFWS and GSMFC 1995). This migration typically occurs from mid-March through June (Rogillio et al. 2007). Most adults spend 8 to 9 months each year in rivers before returning to an estuary or the Gulf of Mexico by mid-November to early December. Thus, the Gulf sturgeon spends the majority of its life in fresh water (USFWS and GSMFC 1995). The diet of the Gulf sturgeon consists predominantly of invertebrates. The types and sizes of invertebrates consumed vary according to life history stage and annual migration. Soft-bodied prey species appear to be preferred over armored or spiny organisms. Juveniles consume amphipods, isopods, annelid worms, chironomid larvae, and other aquatic insects, small bivalves, and small shrimp. Subadults also consume ghost or mud shrimp. Adults in estuaries and coastal waters consume mainly amphipods, isopods, gastropods, brachiopods, polychaete worms, lancelets, and shrimp. Detritus is consumed incidentally while foraging in sediment, while bony fish are seldom eaten (USACE 2006b).

Critical habitat designated for the Gulf sturgeon in Louisiana includes Lake Pontchartrain east of the Lake Pontchartrain Causeway, Little Lake, the Rigolets, Lake Catherine, Lake Borgne, and the Mississippi Sound. These critical habitat units follow the shorelines of each water body. Estuaries and bays located adjacent to riverine units were designated as critical habitat to protect unobstructed passages for sturgeon between feeding and spawning areas (USACE 2006b). Studies conducted by the LDWF have shown the presence of Gulf sturgeon in Lake Pontchartrain, the Rigolets, and Lake Borgne during the winter and during periods of migration to and from marine environments. Gulf sturgeon critical habitat was designated in each of these areas (USACE 2006b). Most records of Gulf sturgeon from Lake Pontchartrain have been located east of the Causeway Bridge, particularly on the eastern north shore. Although Gulf sturgeon has been reported to inhabit Lake Pontchartrain west of the Causeway, typically near the mouths of small rivers on the north shore, critical habitat was not designated for the western half of the lake because these sturgeon are thought to have come from western tributaries and not

the Pearl River (USFWS and NMFS 2003). In addition, observations of Gulf sturgeon in marine and estuarine habitats are associated with sand and mud bottoms (USFWS and GSMFC 1995), and sediment data from Lake Pontchartrain indicate that sediments from the eastern half of the lake have a greater sand content than those from the western half (Barrett 1976, as cited in USFWS and NMFS 2003). This is another reason for only half of Lake Pontchartrain east of the Causeway Bridge to be designated as critical habitat for the Gulf sturgeon.

Offshore critical habitat for the Gulf sturgeon extends from Lake Borgne and the Rigolets along the Gulf Coast to the Suwannee Sound, Florida. Sturgeon migrations to rivers that enter Lake Pontchartrain follow routes through Lake Borgne and the Rigolets. The only recent sighting of Gulf sturgeon within the MRGO occurred during a sonic tracking study completed by the USACE ERDC on January 19, 2005. The ERDC tracked a Gulf sturgeon moving from within the MRGO above Bayou La Loutre toward the marsh adjacent to the MRGO. Additionally, Gulf sturgeon have been collected in Breton Sound and from bayous connected to the MRGO. This suggests that, due to the proximity of the MRGO to the Breton Islands, sturgeon may use this channel as a passageway from Lake Borgne to the islands (USACE 2006b). However, the MRGO has not been designated as critical habitat (USFWS and NMFS 2003).

Kemp's Ridley, Loggerhead, and Green Sea Turtles

Sea turtles inhabit tropical and subtropical marine and estuarine waters around the world. Of the seven species in the world, six occur in the U.S., and all are listed as threatened or endangered. The three species identified by NMFS as potentially occurring in the vicinity of the HSDRRS project area are similar in appearance, though they differ in maximum size and coloration. The Kemp's ridley is the smallest sea turtle; adults average about 100 pounds, with a carapace length of 24 to 28 inches, and a shell color that varies from gray in young individuals to olive green in adults. The loggerhead is the next largest of these three species; adults average about 250 pounds, with a carapace length of 36 inches and a reddish brown shell color. The green is the largest of the three; adults average 300 pounds to 350 pounds with a length of more than 3 ft, and brown coloration (its name comes from its greenish colored fat). The Kemp's ridley has a carnivorous diet that consists mainly of crabs and may also include fish, jellyfish, and mollusks. The loggerhead has an omnivorous diet that includes fish, jellyfish, mollusks, crustaceans, and aquatic plants. The green sea turtle has a herbivorous diet of aquatic plants, mainly seagrasses and algae, which is unique among sea turtles (NMFS 2008).

All three sea turtle species are known to forage as juveniles and adults in nearshore waters in Louisiana, including estuaries, and may be more likely to occur there in months when the waters are warmer. The Kemp's ridley and loggerhead turtles may find suitable foraging habitat for invertebrates and fish in the waters of Lakes Pontchartrain and Borgne. The green turtle would be less likely to occur there due to the scarcity of the submerged aquatic vegetation on which they feed. All three species nest on sandy beaches, which are not present in the project area, and the Kemp's ridley has not been reported to nest anywhere in Louisiana. None of these species have designated critical habitat in the region (USFWS 2007c).

4.2.8.2 Impacts of HSDRRS

4.2.8.2.1 HSDRRS 2011 Impacts

Each of the IERs was submitted to the USFWS and NMFS for review along with a request for concurrence with the USACE's determination of effect on protected species. Table 4-16 summarizes the effects on each of the Federally listed species, and concurrence was received from USFWS and NMFS on all determinations. Of the IERs completed by November 15, 2010, 14 reported that effects on threatened or endangered species may occur, but adverse effects were not likely to occur; it was determined that for the remaining IERs, no adverse effects would occur.

Table 4-16. Summary of the HSDRRS Impacts on Threatened and Endangered Species by IER¹

IER* #	Project/Parish	Species Potentially Present	Determination	Comments
1	LaBranche/St. Charles	Manatee	No effects	Highly unlikely that manatees entered the canals and drainages; drainage control structures are too far upstream for manatee presence
S 1	LaBranche/St. Charles	Manatee	Not likely to adversely affect (NLAA)	USFWS Concurrence of NLAA
2	Lake Pontchartrain/Jefferson	None	No effects	
S 2	Lake Pontchartrain/Jefferson	None	No effects	
3	Jefferson East Bank/Jefferson	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA	Temporary disturbance to foraging areas during construction for manatee and sturgeon; permanent impacts on 9 acres and temporary impacts on 29 acres of Gulf sturgeon critical habitat; implemented manatee and sturgeon BMPs
S 3.a	Jefferson East Bank/Jefferson	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA	Temporary disturbance to foraging areas during construction for manatee and sturgeon; implemented manatee and sturgeon BMPs; loss of 8 acres of bottom feeding areas for sturgeon
4	New Orleans Lakefront west of IHNC	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	No effects	All project construction occurred on land
5	Outfall Canals at 17 th Street, Orleans Avenue, and London Avenue	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA; adverse modification of sturgeon critical habitat (CH) (3.3 acres)	Temporary impacts on sturgeon and turtle foraging habits; the potential for the permanent loss of 3.3 acres of sturgeon critical habitat; no effect on manatee
6	Citrus Lakefront	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA; adverse modification of sturgeon CH (6.9 acres)**	Temporary impacts on 61.1 acres of lake bottom comprising sturgeon and turtle foraging habits; no effect on manatee
S 6	Citrus Lakefront	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	No effects	Different design of I-wall

Table 4-16, continued

IER* #	Project/Parish	Species Potentially Present	Determination	Comments
7	New Orleans East Lakefront to Michoud Canal	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA; adverse modification of shoreline (7.2 acres)**	Temporary disturbance to 118.1 acres lake bottom foraging areas during construction for manatee and sturgeon; implemented manatee and sturgeon BMPs
S 7	New Orleans East Lakefront to Michoud Canal	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA	Temporary disturbance to foraging areas during construction of barge access for manatee and sturgeon; implemented manatee and sturgeon BMPs
8	Bayou Dupre	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA for manatee; no effect on other species	Temporary disturbance to foraging areas during construction for manatee; BMPs were implemented
9	Caernarvon Floodwall	Manatee and Gulf sturgeon	NLAA on manatee; no effect on sturgeon	Temporary disturbance for foraging areas for manatees
10	Chalmette Loop	Manatee, Gulf sturgeon and loggerhead sea turtle	NLAA	
11 Tier 2 Borgne	IHNC-Borgne	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA	Temporary and permanent impacts; permanently converted approximately 122 acres of emergent marsh and open water bottom
S 11 Tier 2 Borgne		Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	No effects	Eliminated vertical gate
11 Tier 2 Pontchartrain	IHNC Pontchartrain	Manatee, Gulf sturgeon, Kemp's ridley, loggerhead, and green sea turtles	NLAA	Temporary and permanent impacts; permanently converted 7 acres of open water bottom
12/S 12	GIWW, Harvey and Algiers Floodwalls	None	No effects	
13	West Bank, Hero Canal, and Eastern Tie-In	None	No effects	
14	Westwego to Harvey	None	No effects	
S 14.a	Westwego to Harvey	None	No effects	

Table 4-16, continued

IER* #	Project/Parish	Species Potentially Present	Determination	Comments
15	Lake Cataouatche	None	No effects	
16/S 16.a	West Bank Western Tie In	None	No effects	
17	West Bank Company Canal	None	No effects	
18	GF Borrow, Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard parishes	None	No effects	
19	Pre-Approved Contractor Borrow, Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard parishes	None	No effects	
22	GF Borrow, Jefferson and Plaquemines, St. Charles, and St. Bernard parishes	None	No effects	
23	Pre-Approved Contractor Borrow, Plaquemines, St. Charles, and St. Bernard parishes and Hancock County	None	No effects	
25	GF Borrow, Orleans, Jefferson, and Plaquemines parishes	None	No effects	
26	Pre-Approved Contractor Borrow, Jefferson, Plaquemines, and St. John the Baptist parishes and Hancock County	None	No effects	
27	Outfall Canal Remediation at 17 th Street, Orleans Avenue, and London Avenue	None	No effects	Project was remediation of floodwalls
28	GF Borrow Site, Plaquemines, St. Bernard and St. Tammany parishes	None	No effects	
29	CF Borrow, Orleans, St. John the Baptist and Jefferson parishes	None	No effects	
30	CF Borrow, St. Bernard and St. James parishes and Hancock County	None	No effects	

Table 4-16, continued

IER* #	Project/Parish	Species Potentially Present	Determination	Comments
31	CF Borrow in East Baton Rouge, Jefferson, LaFourche, Plaquemines, St. Bernard and St. Tammany parishes	None	No effects	
32	CF Borrow, Ascension, Plaquemines, and St. Charles parishes	None	No effects	

*S – Supplemental

** Impact from raising foreshore protection, potentially occurring between 2014 and 2057 (6.9 acres for IER #6 and IER Supplemental #6 and 7.2 acres for IER #7 and IER Supplemental #7).

¹ Includes all NEPA Alternative Arrangement documents completed by November 15, 2010.

A Biological Assessment was submitted under Section 7 of the ESA for formal consultation for the improvements to the outfall canals at 17th Street, Orleans Avenue, and London Avenue. According to the Biological Opinion issued for this project component, the improvements resulted in an adverse modification of 3.3 acres of critical habitat for the Gulf sturgeon. However, NMFS concurred that there was likely no adverse effect on the sturgeon, manatee, pelican, or sea turtles, even though these species could forage or migrate near or within the potential area of effect. None of the project components addressed in the remaining 23 IER and IER Supplemental documents were considered to have had the potential to affect protected species, primarily because the species or their required habitat were not found in the HSDRRS project area.

The types of effects on each of the species that resulted from the HSDRRS projects are described below, by species. Mitigation and conservation measures that were implemented to further reduce the potential for these effects are described in section 5.0 and resulted in negligible impacts on protected species in all sub-basins. No take of threatened or endangered species has been documented during HSDRRS 2011 construction activities.

West Indian Manatee

The USACE determined that the potential for a manatee to be in the project area during construction was unlikely, and the USFWS concurred that the HSDRRS was not likely to adversely impact this species. The USACE committed to implement BMPs to further reduce the potential effects. These measures included, but were not limited to, reducing vessel traffic speed, posting signs of the potential presence of manatees, and halting construction activities in the event a manatee was observed in the area.

Gulf Sturgeon

The Gulf sturgeon was temporarily affected during construction activities due to increased turbidity, construction noise, potential disruption to migration paths, and vessel traffic. These effects dissipated upon completion of the HSDRRS construction. During the construction of the Seabrook gate complex (sector gate and two vertical lift gates) at the IHNC, as part of the effort to minimize impacts on Gulf sturgeon, a USACE biologist was on-site during the dewatering of the cofferdam. The cofferdam was scanned using a side scanner and checked with gill nets and an electroshocker to ensure that Gulf sturgeon were not entrained within the cofferdam, thereby minimizing impacts on Gulf sturgeon. As described in IER #3, access channels were dredged during construction, which temporarily impacted 29 acres near the Bonnabel Pump Station by disturbing the lake bottom and causing increased turbidity. NMFS determined that these impacts, given the vast habitat still available in Lakes Pontchartrain and Borgne and possibly the lack of primary constituent elements, were not significant.

Sea Turtles

The LPV projects in the Jefferson East Bank, Orleans East Bank, New Orleans East, and Chalmette Loop sub-basins temporarily impacted Kemp's ridley, green sea turtle, and loggerhead sea turtle from disturbances to foraging areas, potential migration paths or patterns, and noise. Permanent impacts on foraging areas, due to the conversion of approximately 122 acres of emergent marsh and open water to the surge barrier (IER #11 [Tier 2]), impacted these species, but the NMFS concurred with the USACE that these actions did not likely adversely affect these species.

4.2.8.2.2 HSDRRS 2057 Impacts

Impacts on threatened and endangered species from the future construction activities associated with levee lifts (dredge, fill, and water body displacement) within the project area are expected to be short-term and minor, and permanent impacts would be negligible. Additional impacts on Gulf sturgeon and sea turtles would occur if repair or construction of foreshore protection and

wave attenuation features and associated dredging and dredged material stockpiling in Lake Pontchartrain (Orleans sub-basin) were conducted. These construction activities were described in IERs #6 and #7, but were determined to be unnecessary to provide 100-year level of risk reduction for HSDRRS 2011 and were not constructed as part of HSDRRS 2011.

Short-term construction-related direct impacts from the future levee lifts construction would include decreased DO levels in the waters immediately surrounding the construction site, excessive turbidity due to construction runoff and sedimentation, and increased water body temperature due to the increased suspended solids produced during construction that could absorb solar radiation. Decreased water quality would adversely impact habitat used by West Indian manatee, sea turtles, and Gulf sturgeon. Suspended solids decrease visibility for foraging, migrations, and escaping predators. There are also likely temporary, minor water quality impacts due to increased nutrient loading, sediment oxygen demand, miscellaneous debris, and accidental spills from construction equipment. These impacts may delay or prohibit reproduction, damage food sources, or damage individuals. BMPs, SWPPP measures, and Spill Prevention Control and Countermeasures Plans implemented on construction sites in the future would minimize levels of sedimentation, debris, or spills reaching waterways.

Indirect impacts include alterations to hydrology, which could result in water column impacts, alteration of patterns, water circulation, and normal water fluctuations, in addition to changes in salinity and nutrient loads in the water. After construction, the conditions would be expected to stabilize, allowing for suspended sediments to settle and vegetation to recolonize the area. Construction-related impacts would also affect lake bottoms, canal bottoms, drainage waterways, and open water. Direct impacts from dredging include increased turbidity during dredging, disruption of water bottoms from access channels and material stockpiles, and destruction of SAV.

The foreshore protection addressed in IERs #6 and #7 could be implemented by 2057 within the New Orleans East sub-basin. Repair and construction of the foreshore protection would permanently impact approximately 6.9 acres of lake bottom and 7.2 acres of shoreline and wetlands fringe, and temporarily impact 179.2 acres of lake bottom, which would also have direct impacts on water quality and protected species habitat. Mitigation measures for this future foreshore protection work would be necessary to minimize any potential impacts on Gulf sturgeon. These mitigation measures are outlined in section 5.3.2.4.

4.2.8.3 Cumulative Impacts

4.2.8.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

The HSDRRS projects and their associated excavation of borrow areas contribute to cumulative impacts on the water quality of protected species habitat and designated Gulf sturgeon critical habitat in the HSDRRS project area. Direct impacts on protected species habitat occurred as a result of filling waterways and wetlands (open water aquatic, fresh marsh, brackish, and swamp habitats) for ROW for the HSDRRS; some additional habitat could be lost from future levee lifts through expanded levee footprints, but it is anticipated that these habitat losses would primarily occur on poor quality habitat at the toe of existing levees.

The direct cumulative impacts on protected species habitat are associated with construction activities; the associated dredge, fill, and material stockpiling activities; water body displacement; and hydrologic modifications of waterways and ecosystems. The cumulative HSDRRS construction and operational activities would likely cause sedimentation and contamination of waterways from stormwater runoff during rain events. These direct impacts include changes in water temperature, salinity, turbidity, DO, hydrology, and water velocity. These water quality impacts would impact West Indian manatee, Gulf sturgeon, and sea turtles by impacting their aquatic habitat and potentially impacting their food sources, abilities to

forage, and visibility for migration and escape from predators. However, through Section 7 consultation and the implementation of conservation measures as recommended by USFWS and NMFS, the permanent cumulative impacts on protected species are negligible.

4.2.8.3.2 Cumulative Impacts of Present and Future Regional Actions

Present and future regional actions by USACE or other Federal agencies are Federally mandated to avoid impacts on threatened and endangered species. All Federal projects would be coordinated with the USFWS and the NMFS for determination of impact on threatened and endangered species prior to implementation, which minimizes the likelihood of direct, indirect, or cumulative adverse effects. Cumulative impacts stemming from drastic changes in land use from natural to developed, such as expansion of levee footprints into marshes, construction of confined disposal areas, and bridge improvement projects, could be a detriment to any of the protected species. However, some projects that enhance habitat through restoration or creation would have beneficial effects on threatened and endangered species. The benefit would include an increase in suitable nesting, loafing, and foraging habitat, as well as an increase in prey species abundance.

4.2.8.3.3 Summary of All Cumulative Impacts for Threatened and Endangered Species

Within much of the HSDRRS project area (St. Charles, Jefferson, Chalmette Loop, Gretna-Algiers sub-basins), no cumulative direct or indirect impacts on threatened and endangered species would be expected to occur. However, as other regional projects are implemented, additional adverse modification of Gulf sturgeon critical habitat could occur in the Orleans East Bank and New Orleans East sub-basins. These modifications would contribute to the cumulative adverse impacts on adjacent critical habitat for the Gulf sturgeon; however, regionally these impacts would be negligible.

Cumulative indirect permanent impacts from the conversion of natural areas could also increase marsh fragmentation, alter hydrology, and, in turn, affect habitat quality, making the area unsuitable for some threatened and endangered species.

Other projects proposed in southeastern Louisiana would potentially lessen impacts from implementation of the HSDRRS, including projects such as freshwater reintroduction from the Bonnet Carré spillway, CFDC, and other CWPPRA diversion projects, as well as other coastal and wetlands restoration projects. Projects such as these would provide cumulative long-term beneficial impacts on threatened and endangered species. Some of these projects in southeastern Louisiana would include restoration projects, such the Bayou Bienvenue Restoration, which would create numerous acres of marsh and swamp through the placement of dredged sediments from the Mississippi River. Other proposed projects such as shoreline protection projects would positively impact Lake Pontchartrain and Breton Sound, resulting in lower salinity marshes with greater heterogeneity and interspersed. Enhancement of habitat through wetlands and coastal restoration projects would provide long-term benefits to the area and would be beneficial to threatened and endangered species.

4.2.9 Cultural Resources

4.2.9.1 Affected Environment

The HSDRRS is the undertaking of the USACE, a Federal entity, and as such, is subject to the Section 106 guidelines and processes under the NHPA, as amended, and its implementing regulations at 36 CFR Part 800. The USACE is required to consider the effects of its projects upon cultural resources. It is the duty of the USACE to identify and evaluate all cultural resources within a project area, as well as provide this information to the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officers (THPO), and other consulting

parties for review and comment on all cultural resources within the Area of Potential Effect (APE). Cultural resources included in or determined eligible for listing on the National Register of Historic Places (NRHP) are designated in the regulations as “historic properties” and include any prehistoric or historic district, archaeological site, structure, or object.

4.2.9.1.1 Historic and Existing Environment

The Paleo-Indian Period (11,500 to 10,000 years before present [BP]) is characterized by changes to the deltaic plain due to sea-level rise and the avulsion of the Mississippi River. The modern course of the river was generally set around 1,200 BP. The HSDRRS project area and surrounding parishes and landscape postdate the Paleo-Indian Period and most of the Archaic Period (10,000 to 3,000 BP). Evidence of earlier occupation in the current study area would likely be deeply buried in the alluvial landscape (Saucier 1994).

The Archaic Period (Meso-Indian Period) is characterized by a shift away from large game hunting towards an increased dependence on wild plant sources and small game hunting. It is often broken into three stages with different attributes and inventions (Anderson 2001; Weinstein and Kelley 1992):

- The Early Archaic (10,000 to 8,000 BP)
 - Series of distinctive projectile points.
 - Social organization at the band level with reliance on seasonal rounds of hunting and gathering.
- Middle Archaic (8,000 to 5,000 BP)
 - Regional differentiation of cultures.
 - Increased presence of ground stone tool technology, possibly suggesting an increase in reliance on plants over meat.
 - Appearance of mound complexes on the landscape in northern Louisiana.
- Late Archaic (5,000 to 3,000 BP)
 - Mound building continues into this period with its culmination of the Poverty Point Culture. Named for a large mound complex in northeastern Louisiana, the Poverty Point Culture (3,500 to 2,500 BP) is typically characterized by large permanent settlements and outlying communities linked by trade networks across most of the southeastern U.S. Artifacts associated with this culture include Poverty Point objects, or baked clay cooking balls, and artifacts produced through the microlithic and lapidary industries.
 - The HSDRRS project area and surrounding parishes would have been sub-deltaic marsh during this period; however, evidence of Poverty Point Culture in this area includes small shell middens on the shores of Lake Pontchartrain, Mississippi’s Claiborne site (22HA501), the Little Woods middens (16OR1-5), Big Oak Island 16OR6, and the Linsle site 16OR30.

The Neo-Indian Period (3,000 to 500 BP) is characterized by the introduction of ceramics, domestication of plants, and the introduction of the bow and arrow. Cultural changes include increase in sedentism and stratified societies. Mound building becomes a major and highly developed practice focusing on ceremonial, mortuary, and political activity. Numerous distinct cultural groups fall within this period (Gibson 1994; Russo 1994; and Saunders 1994).

- Tchefuncte Culture (2,500 to 2,000 BP)
 - Hunter-gatherers with some horticulture.
 - Cultivation of squash and bottle gourd.
 - Hunted deer, raccoon, ducks, muskrat, otter, bear, gray fox, ocelot and alligator.

- Known for shell middens comprised of rangia clam.
 - Lithics include adzes, drills, hammerstones, scrapers and projectile points.
 - Groundstone artifacts include abraders, atlatl weights, beads, grooved plummets, and mortars.
 - Baked clay objects begin to dwindle from prominence. Plain, stamped, punctuated and incised tempered ceramics are also typical.
- Marksville Culture (2,000 to 1,600 BP)
 - Closely allied with the Hopewell Culture of Ohio and Illinois River Valleys.
 - Mounds (dome-shaped) were constructed as burial mounds for the political elite.
 - Usually accompanied by grave goods.
 - Ceramics sport characteristic broadly incised lines and rocker stamping.
 - Speculation of Marksville subsistence patterns suggests hunting and intensive gathering of wild foods. Little to no evidence exists for maize agriculture.
 - Southern Louisiana sites with Marksville components include Big Oak Island (16OR6), the Coquille site (16JE37), and the Boudreaux site (16JE53).
 - Baytown Culture (1,600 to 1,300 BP)
 - Also called Troyville.
 - Associated with the introduction of several new types of ceramics.
 - Sites within the HSDRRS include the Mulatto Bayou site (16SB12) and four unnamed sites in Plaquemines Parish (16PL25-31).
 - Coles Creek (1,300 to 800 BP)
 - Social organizational shifts to hamlets/villages surrounding a central pyramidal earthen mounds or platform mounds.
 - Distinctive decorations and techniques on ceramics.
 - Mississippian Culture (800 to 300 BP)
 - Continued platform mounds, shell tempered ceramics, distinctive ceramic forms (i.e., effigy vessels).
 - Increase in social and political organization agriculture-based chiefdom with substantial trade of agricultural goods.
 - Within the HSDRRS an example is the Fleming site (16JE36).

History

The first Europeans thought to have passed through southern Louisiana were with the De Soto expedition of 1541. After the death of De Soto, his men traveled along the Mississippi River to the Gulf of Mexico. It is unknown if contact was made with Native Americans. In 1682, LaSalle led an exploration of the southern Mississippi River claiming the entire river valley for King Louis XIV, the state's namesake. Little is known of the native groups of this time. Explorers tend to contradict each other, likely due to the length of time between parties and the changing cultural patterns in the area (Jeter and Williams 1989; Williams 1989).

The French (1699 AD)

The first settlement in the Louisiana Territory was Fort Maurepas in what is now Ocean Springs, Mississippi. Later exploration of the Mississippi River led to information garnered about Bayou Manchac (an alternate route to the Gulf of Mexico) from local natives. Following Bayou Manchac led the explorers to Lake Maurepas, Lake Pontchartrain, and finally Bayou St. John, which came within 2 miles of the Mississippi River across the natural levee of the river. This made New Orleans a strategic placement for a settlement (McWilliams 1981; Campanella 2006).

The French began issuing land grants in arpents (the French long-lot). This style of land division is still seen in south Louisiana today and is predominant in New Orleans. New Orleans was established in 1718 as the capital of Louisiana. Trade with other nations and Native Americans was predominantly for fur, and the French worked at subsistence farming to support the population. Later, the plantation system was introduced. A hurricane in 1722 destroyed most of New Orleans, after which the settlement was resurveyed, giving it the dimensions and the place names still used today. The first man-made levees were erected by 1727, measuring 1 mile long, 3 ft high, and 18 ft across (Campanella 2006).

After the French and Indian War (1754 to 1763), England gained control of Louisiana east of the Mississippi River, while the French had secretly ceded land west of the Mississippi River to Spain. Acadians expelled from Canada by the English migrated to the French territory of Louisiana, and are known today as Cajuns.

The Spanish (1769 AD)

Although ceded to Spain in 1762, Louisiana was not publically held under Spanish rule for 7 more years. In 1788, a fire in New Orleans destroyed most of the wooden buildings of the French, leaving Spain to rebuild. In 1794, three hurricanes and a fire destroyed most of the Spanish rebuilding efforts, and the remaining French structures. Spain rebuilt the Vieux Carre (French Quarter) again in 1795, resulting in the architecture seen there today (Campanella 2006; Toledano 1971).

The first Faubourg or suburb was established under Spanish rule. Faubourg Saint Mary (later known as St. Marie, and the American Sector), is located in what is now part of the Central Business District and the Warehouse District.

The French (1800 AD)

A treaty with Spain returned Louisiana to the control of the French in 1800. Napoleon wanted Louisiana because of its strategic placement that would halt U.S. expansion and help to supply the West Indies, which was also under French control. With the slave and free black revolt on Santo Domingo, French troops were forced to return to France. Loss of the control in Santo Domingo made the possession of Louisiana unnecessary. The U.S. expressed interest in control of Louisiana, and purchased the territory in 1803 for \$15 million (Barry 1973; Chidsey 1972).

The Americans (1803 AD)

In 1812, Louisiana became the 18th state in the union. With war against England looming, Louisiana began repairing French and Spanish fortifications such as Fort St. Phillip. New fortifications replaced those beyond repair (i.e., Fort Jackson in Plaquemines replaced the old Fort Bourbon). The War of 1812 did not reach New Orleans until late in 1814 after the Treaty of Ghent was signed. News of the war's end did not reach Louisiana for another few months (Thayer 2006).

Early in the 19th century, Faubourg Marigny was established downriver from the Vieux Carre, both of which remained Creole, while the St. Mary Faubourg became the American Sector. Many new faubourgs were established in Mid-City, and the Lower Garden District area (Campanella 2006; Toledano 1971). Vegetable farming, oyster harvesting, and fishing helped to support the economy, but sugar and rice plantations were the dominant industries of southeast Louisiana.

Disputes over slavery in the new western territories and the election of Abraham Lincoln as President in 1860 preceded South Carolina's succession from the Union, which was closely

followed by Louisiana and other states. As the largest city in the Confederacy and given its strategic location, New Orleans was immediately a target for the Union. Starting at the mouth of the Mississippi River, Union soldiers in ships fought their way upriver over a period of 7 days until they arrived in New Orleans and demanded surrender of the city. The Union officially took control of the city on May 1, 1862. The Union was victorious and the war ended in 1865. New Orleans remained the capital of the State of Louisiana until 1882 (Rickard 2007; Davis 1881).

The economy suffered after the Civil War ended. The plantation model relied heavily on slavery in order to operate. Plantations were rendered inoperable, if not destroyed, and the banks failed. The state held a debt of \$53 million by 1874. Plantations in operation mostly employed the freed slaves as sharecroppers or farmhands. Many owners of plantations began recruiting Chinese and Sicilian immigrants as laborers. Diverse backgrounds also brought more diverse industry to southeastern Louisiana, including fruit production. With the coming of the railroad, and with the help of the influx of imports and exports through the Port of New Orleans, southeast Louisiana recovered from the economic crisis (Campanella 2006; Crouere 2009).

During the 20th century, southeast Louisiana has increased the role of the seafood industry in the economy. The discovery of oil, natural gas, and sulphur in southeast Louisiana and the Gulf of Mexico has allowed the petro-chemical industry to become a major part of the local economy.

In August 2005, Hurricane Katrina made landfall on the Gulf Coast, east of New Orleans. The storm surge pushed water back into Lake Pontchartrain and up the Mississippi River. The effects of the storm devastated the southeastern U.S., with Louisiana and Mississippi the hardest hit. Homes, businesses, and other standing structures throughout the HSDRRS project area were damaged or destroyed. This included standing structures that were listed on or eligible for the NRHP. Unknown damage occurred to buried cultural resources as well, due to the flooding of New Orleans and the swollen waterways in the area. The damage to cultural resources from Hurricane Katrina has yet to be fully assessed (Campanella 2006).

Maritime History of Lake Pontchartrain

The navigation of Lake Pontchartrain extends back into prehistoric times to the area's population by a number of Native American tribes. These groups resided in the Lake Pontchartrain Basin and exploited numerous aquatic resources as well as using the lake as a natural transportation and trade route (Campanella 2007). A highly specialized, coastally adapted subsistence strategy developed around the lake with a key component being the rich *Rangia* clam beds and associated predator fish species (Shenkel 1984). Evidence of this exploitation can be seen throughout the region by the presence of hundreds of prehistoric shell midden sites. This subsistence strategy continued through all later cultures into historic contact (Shenkel 1984).

After the arrival of the French in 1699, a route to the Gulf of Mexico along Bayou St. John was adapted to allow the bypass of the longer Mississippi River route. A number of fortifications, beginning with Fort St. John by the French in 1701 (later called Spanish Fort), were established at the confluence of Bayou St. John and Lake Pontchartrain to protect the city from lakeside attack. In 1795, Spanish Governor Carondelet began construction of the Carondelet Canal, which would link the city of New Orleans directly to Bayou St. John, thus allowing direct shipping access to the city from Lake Pontchartrain (Campanella 2007). Additional canals were constructed along the shoreline of Lake Pontchartrain through the 20th century allowing increased access to a number of areas within the city.

As shipping increased, lighthouses were established along the shores of Lake Pontchartrain with the first being installed at Bayou St. John in 1811 (Campanella 2007). This was the first lighthouse to be built in the U.S. outside the original 13 colonies (Campanella 2007). It was followed by the construction of six additional lighthouses through 1855 at various locations

including one at Milneburg in 1832 and another on West End in 1838 (Campanella 2007). Steamboat travel on Lake Pontchartrain began around 1815, with steamers such as the *Louise*, *Francis*, and *Mary*, which were owned by the Morgan Line, sailing daily between New Orleans and Mobile to transport people and deliver goods and mail (Campanella 2007). Locations such as Milneburg, also referred to as Lakeport, were established along the lakeshore and handled shipments to and from Mobile and other locations. Other steamers, known as packets since they served regular routes (Garvey and Widmer 1982), would take both locals and tourists for tours of Lake Pontchartrain, or deliver them to and from the North Shore.

During the Civil War, numerous private and commercial vessels were put in use on the lake to deliver provisions needed by the Confederacy. Steamers such as the *CSS Carondelet*, which was built near Bayou St. John between 1861 and 1862, served as one of those vessels. In the same years the *Carondelet* was constructed, a confederate “Torpedo Boat” submarine was also constructed, but it sank while being tested in Bayou St. John (Campanella 2007). It was later dredged up and displayed at a resort located at Spanish Fort. The period during World War II brought a number of wartime industries and military entities to the shore of Lake Pontchartrain. One of these industries was that of Higgins Industries who designed, built, and tested Higgins boats at their facility located on Pontchartrain Beach (Heller 2008a).

Recreational pursuits, including sport fishing and sailing, are also important to the maritime history of the lake. The Southern Yacht Club moved its headquarters from Pass Christian, Mississippi to the West End, and subsequently held its first regatta in 1857 (Campanella 2007). Additionally, numerous commercial and sport fishing camps once lined the shoreline of Lake Pontchartrain and its adjoining canal, most of which have succumbed to hurricanes over the last century and a half.

HSDRRS LPV Component Levees

The HSDRRS corridor was subjected to an archaeological survey. This required background historical research of the study area and identification of previous cultural surveys and known historic properties to assess the areas of probability for cultural resources. A Phase I cultural resource survey was conducted in the form of pedestrian surface surveys and systematic shovel test pit excavations and delineations, if necessary. Where applicable, a Phase II site evaluation was conducted for testing of eligibility for the NRHP. In all cases, the cultural resource survey areas exceeded the size of the preliminary APE, allowing the USACE project archaeologists to adjust the APE, as needed, to avoid any damage to historic properties with potential eligibility for the NRHP. Nautical remote sensing was conducted in areas of open water included in the LPV and will be discussed in this section first, as they cannot be separated by parish as with the terrestrial surveys.

Nautical Remote Sensing

Based on background research and previous cultural resources investigations in Lake Pontchartrain, it was determined that there was a high potential for cultural resources in submerged portions of the APE. Proposed shoreline protection alternatives, such as riprap placement along the foreshore and stone breakwater placement further offshore, had the potential to impact these potentially significant cultural resources. A nautical remote sensing survey was conducted to identify specific acoustic, magnetic, and sub-bottom anomalies that may represent significant cultural resources. These anomalies could represent the scatter of iron and iron alloy metal objects and non-metal associated with historic shipwrecks on the bottom of Lake Pontchartrain. Prehistoric sites like shell middens can typically be seen with a sub-bottom profiler. All nautical investigations were conducted from the research vessel, *Grey Goose*. This vessel is equipped with two differential Global Positioning Systems (GPS) devices to take location readings, a marine magnetometer, a side scan sonar, a digital sub-bottom profiler, and an

echosounder (Nowak 2008a; 2008b; Lackowicz et al. 2007; Heller et al. 2008a; 2008c; 2008d, 2008e; Heller 2008).

The APE for the nautical remote sensing investigation is located adjacent to the Lake Pontchartrain shoreline and extends continuously for approximately 32 miles within the boundaries of projects described by IERs #2 through #7. The APE generally extended 1,250 feet from the shoreline out into Lake Pontchartrain. Perpendicular flotation channels measuring approximately 400 to 600 feet in width extended beyond the northern boundary of the survey block and were also investigated as part of the APE. The APE measures approximately 4,845 acres in size. Water depths in the APE range from 0 to approximately 15 feet in depth. Areas with a depth of less than 2.5 feet were not surveyed. The Phase I investigation identified several remote sensing targets exhibiting shipwreck characteristics. Phase 2 underwater diving operations were conducted at these targets to determine eligibility for the NRHP.

The nautical APE for IER #2 is located at the mouth of the Parish Line Canal and stretches north into Lake Pontchartrain, measuring 5,000 ft by 900 ft. The survey of the APE for IER #2 found no remote sensing anomalies exhibiting cultural resource characteristics within the proposed flotation channel. The APE of IER #3 includes 9.5 miles of existing levee extending 1,000 ft into Lake Pontchartrain, and four flotation channels that measure 3,000 ft by 600 ft. The channels are located at Duncan Canal, Elmwood Canal, Suburban Canal, and Bonnabel Canal.

Target 15-1 was identified as a potentially significant cultural resource, while later investigation found that Target 15-1 is likely an undocumented and decommissioned well or platform. Target 16-1 is identified as a grouping of three magnetic anomalies that has potential to be a cultural resource. A no-work buffer zone of 350 ft has been placed around this anomaly in order to protect it from impacts. No other targets exhibiting cultural resource characteristics were identified within the APE of IER #3. The APE of IER #4 runs along the Lake Pontchartrain shoreline for 5.8 miles. A total of eight anomalies were identified as targets with the potential to represent cultural resources. However, targets 18-1, 19-1, 19-2, 19-3, 19-4, 19-5, 19-6, and 23-1, were located outside of the APE for IER #4.

The APE for IER #5 includes three separate locations. The 17th Street Canal APE extends 1,850 ft north from the Hammond Highway Bridge into Lake Pontchartrain, and is irregular in shape with an approximate width of 1,000 ft. The Orleans Avenue Canal APE extends south for 2,500 ft from the Lakeshore Drive Bridge, and extends down both sides of the canal with a width of no more than 500 ft. This APE was later amended by shifting it north so that it now falls partially in Lake Pontchartrain. The London Avenue Canal APE measures 2,250 ft by 700 ft in width and is located south of the Lakeshore Drive Bridge. The APE was expanded an extra 140 ft to the north and is now adjacent to the south side of Lakeshore Drive.

A portion of the APE for IER #6 extends along Lake Pontchartrain approximately 1,480 ft from Hayne Boulevard. The portion is 4.85 miles between the South Shore Harbor Marina and Paris Road. Four flotation channels are located within this reach and extend an additional 450 ft to 710 ft in width beyond the 1,480 ft boundary. A portion of the IER #7 APE extends into Lake Pontchartrain approximately 1,250 ft from Paris Road to South Point and includes five flotation channels.

Phase I submerged resource investigations identified seven targets within IER #6 exhibiting characteristics of shipwrecks. Phase II dive investigations were carried out at two of these targets, Target 26-1 (Citrus Lake Front Shipwreck, 16OR97) and Target 28-2. Target 26-1, recorded by Stout (1985) as site 16OR97 is a partially buried large wooden shipwreck from the middle 19th century. The lower portion of the hull, other structural elements, and 35 artifacts were recovered from the wreckage. The artifacts are domestic in nature and may represent the location of the crew's quarters. The wreckage was classified as a commercial sailing vessel and

is considered potentially eligible for the NRHP. Target 28-2 (Site 16OR450, Edge Lake 1 Shipwreck) was identified as a possible historic shipwreck, and was subjected to diving investigations, which confirmed that the anomaly was a wooden shipwreck, though it was mostly buried. The shipwreck featured a relatively flat bottom with a hard chine and transom stern which suggests a V-bottomed sailing scow from the late 19th century, and is considered eligible for the NRHP. Of the remaining targets identified in the Phase I submerged resource survey, Target 26-2 (Site 16OR449, Seabrook 1 Shipwreck), Target 28-3 (Site 16OR451, Edge Lake 2 Shipwreck) and Unknown Shipwreck 1 (Site 16OR452, Edge Lake 3 Shipwreck) could be confirmed as submerged cultural resources. Targets 28-4 and 29-1 appeared to have shipwreck characteristics, but could not be confirmed as such. These seven targets have the possibility of being impacted during the excavation of the flotation channel and, therefore, have been protected by the placement of a 350 ft no-work zone around each target.

Phase I submerged resource surveys identified two anomalies that are potential cultural resources (IER #7). Target 36-1 (South Point 1 Shipwreck, 16OR453) represents a wooden shipwreck with flat floors, engine, drive shaft, and a bronze propeller. The few recovered artifacts include mechanical and electrical objects. The recovered junction box suggests a date of the early 20th century. Archival research failed to produce any information on this shipwreck, and its deteriorated condition prevents identification. Site 16OR453 does not possess the qualities necessary for eligibility for the NRHP. Target 37-1 appeared to have shipwreck characteristics, but could not be confirmed as such. A no-work zone has been placed around Target 37-1 in order to avoid impacts on this resource.

While many targets were identified during the remote sensing survey, no other new submerged cultural resources were identified within the existing ROW for the current project (Nowak 2008a; 2008b; Lackowicz et al. 2007; Heller et al. 2008a; 2008c; 2008d; 2008e; Heller 2008).

Terrestrial Survey

East Bank

St. Charles Parish

The IER #1 APE includes 9.9 miles of existing earthen levee from the Bonnet Carré Spillway East Guide Levee to the St. Charles-Jefferson boundary line. An expansion of the original APE includes an additional 3000 ft of existing earthen levee extending from the eastern end of the original proposed APE to the St. Charles-Jefferson boundary. The total APE extends 500 ft on the protected side of the levee and 1,000 ft on the flood side of the levee. A final addition to the APE consists of a new 2,400 ft long, 54 ft wide temporary access road from an existing industrial park allowing access to the project area where the road terminates.

A portion of the APE encompassing IER #2 work falls within St. Charles Parish. This portion extends 1,000 ft into St. Charles Parish with the centerline of the APE along the Parish Line (Duncan) Canal at the St. Charles-Jefferson parish boundary line for 3.4 miles.

Twelve archaeological surveys had previously been conducted in or adjacent to the APE for the current project within St. Charles Parish (table 4-17). Of these 12 previous surveys, no historic properties were found within the APE of St. Charles Parish. No other NRHP-eligible properties, archaeological sites, or standing structures are known to occur within the HSDRRS LPV project area.

Table 4-17. Previous Archaeological Investigations Within the HSDRRS LPV APE

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
<i>St. Charles Parish</i>			
Weinstein et al. 1977	Cultural Resource Survey of Interstate 410, St. Charles Parish, Louisiana	None Found	N/A
Weinstein 1980b	Cultural Resources Survey of Six Proposed Levee Closures, St. Charles Parish, Louisiana	None Found	N/A
Goodwin et al. 1981	Cultural Resources Survey of the Proposed Sewerage System Development Project, East Bank of St. Charles Parish, Louisiana	None Found	N/A
New World Research 1983	Cultural Resources Survey of Terrestrial and Off-Shore Locations, Lake Pontchartrain and Vicinity Hurricane Protection Project, Louisiana	None Found	N/A
Stuart and Greene 1983	An Archaeological Survey of the Proposed Kenner Revetment (M- 117.2 to 108.6-L), St. Charles and Jefferson Parishes, Louisiana	None Found	N/A
Goodwin et al. 1983	Report on a Level I Cultural Resources Survey of the Riverview Estates, East Bank, St. Charles Parish, Louisiana	None Found	N/A
Heartfield, Price and Greene 1987	A Cultural Resources Survey of a Proposed 24-Inch Diameter United Gas Pipeline Company Pipeline in Ascension, St. Charles, St. James, and St. John the Baptist Parishes, Louisiana	None Found	N/A
Poplin et al. 1988	Phase 2 of the Cultural Resources Inventory of the Bonnet Carré Spillway, St. Charles Parish, Louisiana	None Found	N/A
Hahn and Pearson 1988	Cultural Resources Survey of the St. Charles Parish Hurricane Protection Levee, St. Charles Parish, Louisiana	None Found	N/A
Skinner and Whorton 1995	Cultural Resources Survey Through Pelican Plantation, Louisiana	None Found	N/A

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Kidder 2001	Preliminary Report on an Archaeological Reconnaissance of Bayou Trepagnier, St. Charles Parish, Louisiana	None Found	N/A
Coyle et al. 2006	Phase I Cultural Resources Survey and Archaeological Field Study of the Proposed East-West Corridor Highway Widening Alternative	None Found	N/A
<i>Jefferson Parish</i>			
New World Research 1983	Cultural Resources Survey of Terrestrial and Off-Shore Locations, Lake Pontchartrain and Vicinity	16JE04	Ineligible. No further research necessary.
Rivet 1976	State Project No. 450-15-43, FAP No. I-10-5(163)229 New Orleans Expressway (Causeway Blvd- Junction I-610) Route I-10 Jefferson and Orleans Parishes	None Found	N/A
Rivet 1977	State Project No. 714-22-50, Railroad Relocation and Adjustment, KCS, ICG, SP, and Not Railroads, Williams Boulevard-Shrewsbury, Metairie and Jefferson Parishes, Louisiana	None Found	N/A
Saucier 1952	Louisiana Division of Archaeology Site Form	16JE40	Ineligible. No further research necessary.
<i>Orleans Parish</i>			
Ford and Quimby 1945	The Tchefuncte Culture and Early Occupation of the Lower Mississippi Valley	16OR01-05 16OR08	Unknown. Phase II Site Evaluation should be conducted. 16OR08 presumed destroyed.
Gagliano et al. 1975	Archaeological Investigations Along the Gulf Intracoastal Waterway: Coastal Louisiana Area	16OR55	Unknown. Phase II Site Evaluation should be conducted.

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Neuman 1975	New Orleans East Lakefront Levee, Paris Road to South Point, Orleans Parish, Louisiana	16OR12 16OR28	All unknown. Phase II Site Evaluation should be conducted.
Rivet 1975	Cultural Resources Survey: Route LA US 11 between Intersection of US 11 and US 90, and US 11 and I-10	None Found	N/A
Shenkel 1976	Cultural Resource Survey: Haynes Boulevard Between Downman Road and Paris Rd	16OR11 16OR15 16OR28 16OR24	All unknown. Phase II Site Evaluation should be conducted.
Weinstein 1978	Archaeological Survey of the Gulf Outlet Bridge, I-10 (Spur Route), Orleans Parish	16OR28	Unknown. Phase II Site Evaluation should be conducted.
Gagliano et al. 1979b	Cultural Resource Studies in the Pearl River Mouth Area Louisiana-Mississippi	16OR37	Could not relocate. Presumed destroyed.
Wiseman et al. 1979	Cultural Resources Survey of the Mississippi River-Gulf Outlet, Orleans and St. Bernard Parishes	None Found	N/A
Weinstein et al. 1980a	Cultural Resources Survey of Interstate Route I-510, Orleans Parish	16OR15 16OR28	All unknown. Phase II Site Evaluation should be conducted. 16OR28 ineligible for NRHP. No further research necessary.
Muller 1982	Cultural Resource Survey: North Florida Ave. Levee and Floodwall as well as New Orleans East Lakefront Levee Gap Closures, Orleans Parish	16OR12 16OR28	Both ineligible for NRHP. No further research necessary.
Thomas 1982	Archaeological Investigations at the Linsley Site (16OR40)	16OR41	Presumed destroyed. No further research necessary.

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
New World Research 1983	Cultural Resources Survey of Terrestrial and Off-Shore Locations, Lake Pontchartrain and Vicinity Hurricane Protection Project, Louisiana	16OR24 16OR15 16OR28 16OR12	Neither 16OR15 nor 16OR24 could be relocated. Presumed destroyed. 16OR28 and 16OR12 are ineligible for listing on the NRHP. The 56 standing structures evaluated were found ineligible for listing on the NRHP.
Pearson 1984	Archaeological Evaluation of the Paris Road Site (16OR41), Orleans Parish, Louisiana	16OR41	Presumed destroyed
Stout 1985	Remote Sensing Investigation of the Citrus Lakefront Levee Mobilization Sites, Lake Pontchartrain and Vicinity Hurricane Protection Project, Orleans Parish, Louisiana	None Found	N/A
Pearson and Reeves 1994	Cultural Resource Survey: Bayou Sauvage National Wildlife Refuge, Orleans Parish	16OR12	Presumed destroyed
Smith et. al 1997	Cultural Resources Report for Mississippi River- Gulf Outlet New Lock and Connecting Channels	None Found (Background research only)	N/A
Klinger and Gray 1999	PF.NET, LLC New Orleans-Pensacola Louisiana Documentation, Historic Properties Review of a Proposed Fiber Optics Corridor Within Louisiana Management Units IV and V, Mississippi River Drainage Basin, Orleans and St. Tammany Parishes, Louisiana	None Found	N/A
Thomas and Thomas 1999	Phase I Archaeological Survey of the NASA Michoud Assembly Facility, New Orleans, Louisiana	16OR40	Presumed destroyed

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Cleveland, Chancellor and Holland 2000	Architectural Survey of the NASA Michoud Facility, New Orleans, Louisiana	None Found	N/A
Gray 2006	Louisiana Division of Archaeology Site Form	16OR219	Not eligible for the NRHP. No further work necessary.
Wilson et al. 2006	Cultural Resource Investigation for Floodgate Protection and Levee Construction, Inner Harbor Navigational Canal and Mississippi River Gulf Outlet, Orleans and St. Bernard Parishes	Seabrook Railroad Bridge 16OR219	Bridge is eligible for the NRHP 16OR219 is ineligible for the NRHP. No further research necessary.
Handly et al. 2006	Phase I Cultural Resources Survey and Archaeological Inventory of Three Proposed Temporary Trailer Parks in City Park, Orleans Parish, Louisiana	16OR57 (Fort Pike) 16OR32 (Fort MacComb) Both close to Project Area	Both listed on the NRHP. Monitoring recommended for areas where the APE is close to these sites.
National Park Service (NPS) 2010	National Register of Historic Places Database, Last Accessed 9/13/2010	New Canal Lighthouse Dillard University Historic District Metairie Cemetery 16OR6 16OR7	Listed on the NRHP
Saucier 1952	Louisiana Division of Archaeology Site Form	16OR19	Listed on the NRHP
<i>St. Bernard Parish</i>			
Beavers and Lamb 1987	A Report of an Archaeological Field Investigation of the Adams Construction Company Borrow Pit, St. Bernard Parish, Louisiana	None Found	N/A
Floyd 1981	Cultural Resources Survey of Proposed 24" Pipeline Route from Loop's Clovelly Facilities, Lafourche Parish, to Gulf Oil's Meraux Refinery, St. Bernard Parish	None Found	N/A

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Flayharty and Muller 1982	Cultural Resources Survey of Lake Pontchartrain Louisiana and Vicinity, Verret Closure, Levee Shaping and Creedmore Drainage Structure B/L Sta. 1113+70 to B/L Sta. 1586+08 St. Bernard Parish, Louisiana	None Found	N/A
Gray et al. 2006	Reconnaissance Survey of a Proposed Borrow Area, St. Bernard Parish, Louisiana	None Found	N/A
Jones and Franks 1993	Cultural Resources Survey of the Mississippi River Gulf Outlet Dredged Material Disposal Areas, St. Bernard Parish, Louisiana	16SB84	Potentially eligible
Poplin et al. 1987	Cultural Resources Survey of the Caernarvon Diversion Site, Mississippi Delta Region, Louisiana	None Found	N/A
Shenkel 1977	Cultural Resources Survey of the Poydras Retention Mississippi River Bank Protection Item Mi. 82.0-L Plaquemines Parish and St. Bernard Parish, Louisiana	None Found	N/A
Shuman et al. 1990	Research Design for the Violet Site Alternative, New Lock and Connecting Channels, St. Bernard Parish, Louisiana	None Found	N/A
Warren 2004	Phase I Terrestrial and Submerged Cultural Resources Survey of the Proposed Lake Borgne Bank Stabilization Project at Shell Beach, and Bayou Dupre, St. Bernard Parish, Louisiana	None Found	N/A
Wiseman et al. 1979	Cultural Resources Survey of the Mississippi River-Gulf Outlet, Orleans, and St. Bernard Parishes	None Found	N/A

Table 4-17, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
<i>Plaquemines Parish</i>			
Poplin et al. 1987	Cultural Resources Survey of the Caernarvon Diversion Site, Mississippi Delta Region, Louisiana	16PL150	Ineligible for the NRHP; no further research necessary
Shenkel 1977	Cultural Resources Survey of the Poydras Retevment Mississippi River Bank Protection Item Mi. 82.0-L Plaquemines Parish and St. Bernard Parish, Louisiana	None Found	N/A

N/A-Not Applicable

Field research conducted in the project area began with field reconnaissance to identify high probability areas for the presence of cultural resources, as well as the revisitation of previously known archaeological sites. Sites 16SC65, 16SC66, and 16SC67 were in close proximity to the APE and were revisited to assess current condition and use sub-meter accurate GPS to plot site locations. A final task was to revisit site 16SC80, to determine whether the site extends into the current APE. Field reconnaissance confirmed that aerial and topographic data were accurate, and confirmed the existence of sanitary landfills within the APE.

Sites 16SC65 and 16SC67 are field drainage structures. Each was relocated and found to be outside of the current APE, though 16SC65 is located on the edge or just outside of the southern boundary of the APE and was, therefore, evaluated for the NRHP. The structure is now within a flooded area and has only three remaining walls. Due to the condition of this structure, site 16SC65 is determined not eligible for listing on the NRHP. There was no evidence that 16SC80 extended into the current APE. Finally, Site 16SC66 could not be relocated. Its known location consisted of extensive spoil piles, and the 1988 site form notes possible canal dredging and dismantling had occurred. The location revisited was absent of any evidence of the site, and it is believed that 16SC66 has been destroyed. No other NRHP-eligible sites or structures are located within the project's APE (Lackowicz 2008; Lackowicz 2007a; 2007b).

Jefferson Parish

The APE for IER #2 includes 3.4 miles of levee floodwall and extends 500 ft from the centerline of the Parish Line Canal into Jefferson Parish on the protected side of the levee. The APE also extends 1,000 ft into St. Charles Parish on the flood side of the levee. The APE for IER #3 extends 9.5 miles from the Parish Line (Duncan) Canal to the Jefferson-Orleans parish line at the Metairie Outfall Canal. From the existing levee feature, the APE extends 130 ft on the protected side of the levee and 1,000 ft on the flood side of the levee. As an addition to the original IER #3 APE, expansion of the APE would include an area measuring approximately 1,900 ft by 1,350 ft in order to accommodate a new overpass that would divert North Causeway Boulevard traffic up and over the new T-wall alignment.

Three archaeological surveys had previously been conducted in or adjacent to the APE within Jefferson Parish (IER#3; see table 4-17). Of these three previous surveys, only one historic property was determined to be within the APE of this project in Jefferson Parish. Site 16JE04 (Indian Beach) was recorded in 1952 (Saucier and Gagliano) on a Louisiana site record form. Indian Beach was described as a small beach site with few artifacts. While several structures once occupied this site, the site is recorded as a prehistoric shell midden with brackish water clam, and prehistoric ceramics that date the site to Baytown, Coles Creek, and Mississippi periods. This site was revisited by New World Research (1983) and was found to be badly eroded with few artifacts. Indian Beach (16JE04) was found to be ineligible for the NRHP.

The West End Site (16JE40) was reported on a Louisiana site form by Saucier (1952). It was considered a shell and artifact scatter. The artifacts consisted of prehistoric ceramic sherds that were heavily worn by wave action. The possibility of the artifacts at the West End site belonging to Indian Beach (16JE04) to the west was put forth by Saucier. Because of the poor preservation of the artifacts, Site 16JE40 was found to be ineligible for listing on the NRHP. No other NRHP-eligible properties, archaeological sites, or standing structures are known to exist within the project area. Field reconnaissance and Phase I Surveys were conducted in the high probability areas within the APE of the current project in Jefferson Parish. No new archaeological sites or standing structures eligible for listing on the NRHP were found within the project APE (Lackowicz 2008, Lackowicz et. al 2007).

Orleans Parish

The APE of IER #4 measured 5.8 miles in length and 150 ft wide, extending from the 17th Street Canal to the IHNC. An APE measuring 6.10 miles in length along the shore of Lake Pontchartrain from Jourdan Road to Paris Road was described in IER #6, and included five staging areas. A portion of this APE, 1.25 miles of levee from Jourdan Road to the South Shore Harbor Marina, will not exceed the existing levee ROW. The remaining 4.85-mile section of the APE has an approximate width of 1,480 ft.

The APE established for IER #7 extends approximately 19 miles in length from Paris Road to the Michoud Canal. The portion of the APE from Paris Road to South Point expands to cover 500 ft on the protected side of the levee and 1,250 ft on the flood side of the levee. The APE between South Point and Michoud Canal has a smaller width at 500 ft on the protected side and 1,000 ft on the flood side. Components located outside of the general APE include two staging areas and an existing paved 0.6-mile bike path to be used as an access road. The APE of IER #11 stretches across the Golden Triangle Marsh area from the Michoud floodwall south to the New Orleans side of the MRGO for approximately 2 miles. The width of the APE ranges from 600 ft at the MRGO closure structure, to 1,750 ft along the floodwall segment. Two staging areas and four potential disposal areas were located adjacent to the APE. An amendment to the IER #11 project area was added at a later date. IER #11 Tier 2 Pontchartrain added an area measuring 1800 ft by 2,500 ft to the APE. This portion of the APE is located just to the south of the Senator Ted Hickey Bridge. IER #11 Tier 2 Borgne included additional area to the north and south banks of the construction access channels. These areas had a combined length of 13,000 ft and measure 100 ft wide on the north bank and 150 ft wide on the south bank.

A search of previous records was conducted to determine what work if any had been conducted in the project area in Orleans Parish (see table 4-17). Within the project APE for Orleans Parish, there are no known historic properties eligible for or listed on the NRHP; however, it should be noted that near the project area there are several NRHP-listed properties close to the southern shore of Lake Pontchartrain: Metairie Cemetery, Big Oak Island (16OR06), Little Oak Island (16OR07), Seabrook Railroad Bridge, New Canal Lighthouse, Fort St. John (16OR19), and the Delgado Historic District.

Within the current project APE in Orleans Parish there are eight known archaeological sites. Site 16OR12, the South Point Site, was recorded on a Louisiana State Site Form by Preston Holden in 1939. A prehistoric shell midden, the site was apparently separated from shore in the 1930s, and was suffering the effects of marshland erosion. In 1957, Saucier and Gagliano reported field information on a Louisiana State Site Form on file at Louisiana Division of Archaeology in the State Site Files. In 1983, New World Research reported that the site had been destroyed. Analysis of the prehistoric ceramics curated for 16OR12 found ceramic types diagnostic for many prehistoric periods from circa (ca.) 700 BC to AD 1,700.

Site 16OR28, Little Woods, is described as a heavily eroded and redeposited beach scatter that contains shell and prehistoric artifacts. In 1983, New World Research corrected the plotted location of this site. The corrected location corresponds with the descriptions of the site's location. New World Research performed testing of the site, finding the Little Woods artifact concentration low and mainly in surface deposits. Site 16OR28 was determined ineligible for the NRHP.

Site 16OR37, Demontluzin Camp, was reported in 1959 as a prehistoric shell midden destroyed during the construction of US 90. Historic Research Preservation tried to relocate the site in 1999, but was unsuccessful. Site 16OR37 is presumed destroyed (Klinger and Gray 1999).

The Orleans' Protection Levee (16OR38) was identified as a prehistoric cultural resource consisting of shell and artifacts found in a dredge spoil on the north bank of Bayou Sauvage.

The site is assumed buried or destroyed. Klinger and Gray (1999) attempted to relocate this site also, but were unsuccessful.

The Bayou Sauvage Site (16OR70) was recorded in 1986. The site was described as a large earth midden containing several fragments of possible daub, suggesting the remains of prehistoric structures at the site. Artifacts associated with the site suggest occupations as early as ca. 700 BC and as late as ca. AD 1700. This site has been evaluated and found eligible for listing on the NRHP.

In 1951, Gagliano and Saucier recorded site 16OR24, an approximately 1-mile-long series of shell middens. The site was described as having shell deposits on the beach and clusters of live oak trees. Shenkel (1976) plotted two loci, both with shell deposits on the beach and live oak clusters. Neither recorder mentioned artifact collection or observation. In 1983, New World Research was unable to relocate 16OR24, and it is presumed misplotted or destroyed.

Heller et al. (2008b) performed a cultural resource study within Orleans Parish for the current project area, a staging area located on Crowder Boulevard, and another staging area located along Read Boulevard. It is only these two specific places in which new cultural resources were identified within the project APE.

A single site, 16OR444, and one non-site locus were identified at the Crowder Boulevard staging area. Site 16OR444 yielded artifacts, including brick, whiteware ceramic sherds, a square cut nail, and a piece of slate tile. These artifacts were found between 0 and 12 inches below surface. Results of testing indicate that Site 16OR444 is a low-density historic scatter, dating between ca. 1790 and 1890. It is likely that the artifacts recovered from the top stratum represent redeposited materials, but even if this material is in context, Site 16OR444 does not exhibit sufficient integrity for nomination to the NRHP.

Non-site locus 06-B-02 was identified as a historic/modern artifact scatter. None of the artifacts collected from this site could be dated to 50 years or older. The artifacts were excavated from the first stratum only and found upon the surface. This non-site locus is neither eligible for site status, nor eligible for the NRHP.

Within the Read Boulevard staging area, a single site, 16OR446, was identified as a historic site dating to the 19th and 20th centuries. Notable artifacts recovered from Site 16OR446 included brick, mortar, coal, slate, other architectural material, glass, whiteware ceramics, pearlware ceramics, yellowware ceramics, and machine-cut nails. Only the portion of this site situated within the current project APE was tested, although the site is believed to extend beyond these boundaries. Artifacts were found to be in mixed context with modern debris, and demonstrate the highly disturbed nature of the portion of the sites deposits within the current APE. It has been determined that Site 16OR446 lacks sufficient integrity for nomination to the NRHP (Heller et al. 2008a, 2008b, 2008c, 2008d, 2008e; Heller and Hannah 2009; Heller 2008).

Fort St. John, also called Spanish Fort (16OR19), is located on the west bank of Bayou St. John, approximately 1,640 ft south of the mouth of the Bayou at Lake Pontchartrain. The site consists of brick fortifications constructed between 1808 and 1814. These fortifications replaced the earlier earthen and wooden works from the 18th century. This site was abandoned in the 1820s and became a hotel and later an amusement park that closed in the 1920s. Since the 1920s, the site has been utilized as a park and residential areas. Spanish Fort (16OR19) is listed on the NRHP and is located just south of the current APE. As a protection measure against impacts, a no-work zone was placed around this resource.

The Milneburg Lighthouse or Port Pontchartrain Lighthouse is located at the UNO Technology Research Park and served to guide steamships into the Milneburg. Constructed in 1855, the

lighthouse was in operation until 1929. This lighthouse was originally part of the Milneburg and Pontchartrain Park recreational areas and was located thousands of feet offshore. After the land reclamation project of the 1920s, the lighthouse became landlocked. The eligibility of this resource is unknown; however, to avoid impacts on the lighthouse, a 75 ft no-work zone was placed around the site.

Site 16OR448 (Locus 04-02) is located on the east bank of Bayou St. John directly across the Bayou from 16OR19. The site consists of an articulated brick feature surrounded by a dense rangia shell fill and three separate artifact clusters. With the exception of a single pearlware sherd, the artifacts appear to date to the late 19th or early 20th century and may be associated with one or more of the structures recorded in this area from ca. 1880 to 1930. This site has not been assessed for eligibility to the NRHP, and is located just outside of the APE. In order to protect this site from potential impacts, a no-work zone was placed around this resource.

St. Bernard Parish

The Bayou Dupre Floodgate facility discussed in IER #8 has an APE that extends northwest of the centerline of the Bayou Dupre Channel for approximately 1,000 ft, and to the southeast for 1,300 ft. The width of the APE extends 1,000 ft on the flood side of the levee, and from 500 ft to 1,300 ft on the protected side of the levee. A portion of the APE established in IER #9 is located within St. Bernard Parish. The APE is approximately 2,000 ft by 2,750 ft. The APE of IER #10 measures 22 miles from Bayou Bienvenue to Caernarvon. Between Bayou Bienvenue and Bayou Dupre, the 6-mile stretch of the APE has a width of 2,300 ft. The remaining 16 miles has a width of 1,500 ft. The APE for IER #10 includes an expansion in the form of an access road to Highway 46 for the Verret Fire Station. This access road extends under the LA 46 Bridge and runs parallel to the north side of LA 46 for approximately 2,000 ft, with a width of 400 ft.

Background research was conducted to determine what work if any had been conducted in the project area in St. Bernard Parish (see table 4-17). Of the 10 previous cultural resource surveys within or adjacent to the project APE, only one historic property occurred in St. Bernard Parish. Originally recorded on a Louisiana State Site Form by Weinstein and Kelley in 1976, Battery Bienvenue (16SB84) is located near the confluence of Bayou Villere and Bayou Bienvenue. Battery Bienvenue (16SB84) is a 19th century military fortification to protect against invasion of New Orleans through Lake Borgne and Bayou Bienvenue. A visual inspection found the site in disrepair and mostly submerged as per the Wiseman et al. 1979 Louisiana State Site Form. A second visual inspection conducted and recorded on a Louisiana State Site Form by Jones and Franks in 1993 found the structures further degraded and the subsidence of the site continuing as an ongoing problem. Despite the poor integrity of Site 16SB84, Jones and Franks (1993) assessed Battery Bienvenue as potentially eligible for nomination to the NRHP. To protect 16SB84 from any adverse impacts, a 350 ft radius no-work zone has been placed around this resource. No other sites or historic properties were found within the APE of the project in St. Bernard Parish.

As a result of the current study, portions of the Mexican and Gulf Line railroad embankment were identified as Site 16SB160. The portion of the site that falls within the current APE was tested for NRHP eligibility. The portions tested did not exhibit integrity of deposits or research potential and are, therefore, considered ineligible for the NRHP. The portion of the site outside of the current project APE is unknown. Site 16SB161 was identified next to the Creedmore Canal. The site is located on private property and consists of a small historic surface scatter, as well as a brick foundation. The site lies outside of the APE and, therefore, was not tested, but the northern edge adjacent to the observed site was tested. Site 16SB161 does not extend into the APE, but in order to avoid impacts on this site, ground disturbance activities were restricted to 400 ft from the levee centerline in the vicinity of this site. No other archaeological sites or historic standing structures were identified within the current APE (Lackowicz 2007c, 2007d; Heller and Hannah 2008, Heller et al. 2008d).

Plaquemines Parish

The APE described in IER #9 is approximately 2,000 ft by 2,750 ft and, although it is primarily in St. Bernard Parish, a portion of the APE falls within Plaquemines Parish. Background research was applied to determine what work if any had been conducted in the project area in Plaquemines Parish (see table 4-17). Only one site was found to be located within the APE of the project in Plaquemines Parish. Site 16PL150 is a sparse scatter of historic artifacts. The artifacts represented at the site include brick, coal, and amethyst glass. The deposit appeared to be in secondary context, likely a historic structure destroyed by the levee, LA 39 and railroad construction. Site 16PL150 has been recommended as ineligible for the NRHP (Poplin et al. 1987). No other NRHP-eligible properties, archaeological sites, or standing structures are known to exist within the project area. Field reconnaissance was conducted in the project's APE in order to identify any unknown historic properties. No other archaeological sites or historic standing structures were identified as a result of this survey (Lackowicz 2007d).

Westbank

St. Charles Parish

A portion of the APE for IER #16 is located within St. Charles Parish. The APE is approximately 22,300 ft long by 700 ft wide, and is bounded on the west by South Kenner Road and in the east by the Davis Pond Freshwater Diversion Canal. The APE was amended to include Area 1, located where the BN&SF railroad crosses the APE at the Davis Pond Freshwater Diversion Canal, and measures 3,550 ft long by 400 ft wide, and Area 2, which is north of Hwy 90 adjacent to the established APE, and measures 4,950 ft long by 600 ft wide.

Background research was consulted to determine what work if any had been conducted in the St. Charles Parish project area (table 4-18). Of the eight previous cultural resource studies conducted in or near the project area, only one archaeological site was found inside of the project APE. Site 16SC73, a late 19th to early 20th century surface scatter was determined ineligible for the NRHP, and subsequently destroyed by the construction of the Davis Pond Freshwater Canal. As a result, 16SC73 is no longer considered an archaeological site.

During the current survey of the project APE no new archaeological sites or historic standing structures were identified (Wells 2008d).

Jefferson Parish

A portion of IER #12 is located within Jefferson Parish. The APE of IER #12 measures approximately 35 miles in length and generally extends 500 ft on both sides of the levee. A gate option expanded that 500 ft boundary to a larger size in its vicinity. A portion of the APE for IER #16 is located within Jefferson Parish. The APE is approximately 22,300 ft in length by 700 ft wide and is bounded on the west by South Kenner Road and in the east by the Davis Pond Freshwater Diversion Canal. The APE was amended to include Area 1, which is located where the BN&SF railroad crosses the APE at the Davis Pond Freshwater Diversion Canal and measures 3,550 ft long by 400 ft wide, and Area 2, which is north of Hwy 90 adjacent to the established APE and measures 4,950 ft by 600 ft wide.

The APE of IER #14 extends 14.25 miles along the existing levee from Westwego Pump Station 1 to a point located 1.75 miles east of Lafitte-Larose Highway 3141. Most of the APE is included within the existing ROW of the levee, except for a stretch from the Lafitte-Larose Highway 3134 to the end point 1.75 miles down the levee. This portion of the APE extends approximately 300 ft farther than the existing ROW on the protected side of the levee. A later expansion of the APE for IER #14 adds approximately 100 ft to the APE for the flood side of the levee, and extends for 3.6 miles along the levee centerline. The APE for IER #15 measures 7.7 miles in length and extends 1,050 ft on the protected side of the levee and 250 ft on the flood side of the levee. The IER #17 APE extends approximately 2.8 miles in length and 500 ft on both the protected and flood side of the levee.

Table 4-18. Previous Archaeological Investigations Within the HSDRRS WBV APE

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
<i>St. Charles Parish</i>			
Apollonio et al. 2006	Intensive Cultural Resources Survey, Future I-49 South Corridor, St. Charles and Jefferson Parishes, Louisiana	None Found	N/A
Franks and Yakubik 1993	Significance Assessment of Site 16SC61, Luling Revetment, Mississippi River M-116. 7-R	None Found	N/A
Jones et al. 1994	Cultural Resources Survey and Testing for Davis Pond Freshwater Diversion, St. Charles Parish, Louisiana	16SC73	Destroyed
Lee 2001	Archaeological Investigations for the Proposed Three Dimensional Seismic Survey Within and Near the Barataria Preserve of Jean Lafitte National Historical Park and Preserve, Jefferson and St. Charles Parishes, Louisiana	None Found	N/A
McIntire 1979	Cultural Resources Survey of Shell's Proposed Pipeline from Clovelly Oil and Gas Field to Norco, Louisiana	None Found	N/A
McIntire 1984	Cultural Resources Survey of a Proposed L65 Pipeline – St. Charles and Jefferson Parishes, Louisiana	None Found	N/A
Shannon et al. 1996	Cultural Resources Survey of St. John the Baptist, St. Charles, and Jefferson Parishes Construction Items	None Found	N/A
Shuman 2006	Cultural Resources Survey of the Proposed Servitude for a Hurricane Protection Levee, Luling, St. Charles Parish, Louisiana	None Found	N/A

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
<i>Jefferson Parish</i>			
Apollonio et al. 2003	Cultural Resources Survey, Borrow Areas, New Westwego Pump Station to Highway 45, Jefferson Parish, Louisiana	None Found	N/A
Apollonio et al. 2006	Intensive Cultural Resources Survey, Future I-49 South Corridor, St. Charles and Jefferson Parishes, Louisiana	None Found	N/A
Beavers 1981a	Cultural Resource Assessment, Alternate Site Survey, Jefferson Parish, West 201, EIS: Addendum B	None Found	N/A
Beavers 1981b	Cultural Resource Assessment, Alternate Site Survey, Jefferson Parish, West 201, EIS: Addendum A	None Found	N/A
Beavers 1982a	Data Recovery for Area of Adverse Impact by Proposed Facilities at the Barataria Basin, Marsh Unit-Core Area	None Found	N/A
Beavers 1982b	Archaeological Site Inventory: Barataria Basin Marsh Unit-Core Area, Jean Lafitte National Historical Park, Jefferson Parish, Louisiana	None Found	N/A
Beavers and Lamb 1990	A Report of a Level II Archaeological Investigation of the Sparacio Borrow Pit, T.L. James Construction Company, Waggaman, Jefferson Parish, Louisiana	None Found	N/A
Braud et al. 1997	Cultural Resources Investigations at the Live Oak Plantation Site (16JE25)	None Found	N/A
Comardelle and Witschey 1989	Survey of Spanish Colonial Archaeological Sites in the Barataria Unit of the Jean Lafitte National Historical Park and Preserve, Louisiana	None Found	N/A

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Franks and Yakubik 1990	Archaeological Survey of 65 Acres Adjacent to Bayou Des Familles	None Found	N/A
Gagliano et al. 1979a	Cultural Resources Survey of the Barataria, Segnette, and Rig and Waterways, Jefferson Parish, Louisiana	None Found	N/A
Giardino 1984	Overview of the Archeology of the Coquilles Site, Barataria Unit, Jean Lafitte National Historical Park, Louisiana	None Found	N/A
Gibson 1975	Cultural Resources. In Draft Environmental Impact Statement for a New Water Line from Marrero to Lafitte, Louisiana	None Found	N/A
Goodwin 1985	A Cultural Resources Survey of the Proposed Barataria Trail System, Jean Lafitte National Historical Park	None Found	N/A
Goodwin and Poplin 1987	Level II Archaeological Survey, Big Woods Development Area Environmental Educational Center-Phase I, Barataria Unit, Jean Lafitte National Historical Park, Jefferson Parish, Louisiana	None Found	N/A
Goodwin et al. 1989	Cultural Resources Investigations of the West Bank Hurricane Protection Project, Jefferson Parish, Louisiana	None Found	N/A
Goodwin et al. 1994	Cultural Resources Survey of West Bank Levee Construction Items, Waggaman to Gretna, Louisiana	None Found	N/A
Hinks et al. 1991	Cultural Resources Investigations for the Westbank Hurricane Protection Project, Plaquemines and Jefferson Parishes	None Found	N/A

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Holmes 1986	Historic Resources Study: The Barataria Unit of Jean Lafitte National Historical Park.	None Found	N/A
Jones et al. 1997	Cultural Resources Survey of the Westwego to Harvey Canal Hurricane Protection Project, Lake Cataouatche Area, Jefferson Parish, Louisiana	None Found	N/A
Kelley and Bryant 1986	A Cultural Resources Survey of the Estelle Plantation Tract, Jefferson Parish, Louisiana	None Found	N/A
Kidder 1995	Archaeological Data Recovery at 16JE218, Jefferson Parish, Louisiana	None Found	N/A
Lee 2001	Archaeological Investigations for the Proposed Three Dimensional Seismic Survey Within and Near the Barataria Preserve of Jean Lafitte National Historical Park and Preserve, Jefferson and St. Charles Parishes, Louisiana	None Found	N/A
Maygarden et al. 2003	Assessment of the Historic Landscape, Highway 45 Borrow Pit, Jefferson Parish, Louisiana	None Found	N/A
McIntire 1984	Cultural Resources Survey of a Proposed L65 Pipeline – St. Charles and Jefferson Parishes, Louisiana	None found	N/A
Shannon et al. 1996	Cultural Resources Survey of St. John the Baptist, St. Charles, and Jefferson Parishes Construction Items	None Found	N/A
Simmons 2002	Archaeological Investigations at the Live Oak Plantation Site (16JE25), Waggaman, Jefferson Parish, Louisiana	None Found	N/A

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Smith and Weed 2003	Phase I Cultural Resource Investigations, Harvey Boulevard Extension, Jefferson and Plaquemines Parishes, Louisiana	None Found	N/A
Speaker et al. 1986	Archaeological Assessment, Barataria Unit, Jean Lafitte National Historical Park, Jefferson Parish, Louisiana	None Found	N/A
Stach 1996	Cultural Resources Survey of the Westwego to Harvey Canal Hurricane Protection Project from Orleans Village to Highway 45, Jefferson Parish, Louisiana	None Found	N/A
Stanton et al. 2004	Intensive Cultural Resources Survey of the Peters Road Extension, Engineers Road to Louisiana Highway 23, Plaquemines and Jefferson Parishes, Louisiana	None Found	N/A
Swanson 1988	Historic Land Use Study of a Portion of the Barataria Unit of the Jean Lafitte National Historical Park	None Found	N/A
URS 2007	Preparation of Design Alternative Study for the Westbank and Vicinity Hurricane Protection Project, GIWW Navigable Closure Structure Alternatives, 95% Submittal	425 Planters Canal Road	Potentially Eligible Structure, Assess Eligibility
Weinstein and Burden 1976	Impacts on Archaeological Sites	None Found	N/A
Wells 2007	Management Summary: Cultural Resources Survey of a Portion of the West Bank and Vicinity Hurricane Protection Levee, Bayou Segnette State Park, Jefferson Parish, Louisiana	None Found	N/A
Yakubik 1989	Archaeological Investigations of Six Spanish Colonial Period Sites	None Found	N/A

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Yakubik and Dawdy n.d.	Excavations at Orange Grove Plantation, St. Charles Parish, Louisiana	None Found	N/A
Yakubik et al. 1996	Archaeological Data Recovery of the Camino Site (16JE223), A Spanish Colonial Period Site Near New Orleans, Louisiana	None Found	N/A
<i>Plaquemines Parish</i>			
Beavers 1978	Cultural Resources Survey and Assessment of the Proposed U.S. Coast Guard-Gulf Strike Team Building, Coast Guard Air Station Alvin Callendar Field, Belle Chasse, Plaquemines Parish, Louisiana	None Found	N/A
Gagliano et al. 1975	Archaeological Investigations along the Gulf Intracoastal Waterway: Coastal Louisiana Area	16PL40 16PL41	Both unknown. Phase II Site Evaluation is recommended
Hardlines Design Company (HDC) 2000	Phase I Archaeological Survey of the Naval Air Station Joint Reserve Base New Orleans, Plaquemines Parish, Louisiana	None Found	N/A
HDC 2003	Phase I Archaeological Survey of the Proposed Land Acquisition for the Runway Extension and Clear Zone of Runway 4 at the Naval Air Station Joint Reserve Base, New Orleans, Plaquemines Parish, Louisiana	None Found	N/A
Harlan and Nolan 2007	Reconnaissance Survey of the Proposed West Bank N Borrow Area, Plaquemines Parish, Louisiana	None Found	N/A
Hinks et al. 1991	Cultural Resources Investigations for the Westbank Hurricane Protection Project, Plaquemines and Jefferson Parishes, Louisiana	16PL40 16PL41	Both Ineligible. No further research necessary.

Table 4-18, continued

Reference	Report Title	Archaeological Sites/ Historic Standing Structures within the APE	Eligibility and Recommendations
Garson et al. 1982	Cultural Resources Survey of Fourteen Mississippi River Levee and Revestment Items	None Found	N/A
Lee et al. 2000	Cultural Resource Survey for the West Bank Vicinity of New Orleans, Louisiana, Hurricane Protection Project	None Found	N/A
Pietak 1996	Background Research and Archaeological Investigation of Naval Air Station New Orleans, Plaquemines Parish, Louisiana	None Found	N/A
Sewell 2005	Phase II Evaluation of Site 16PL164 at Naval Air Station Joint Reserve Base New Orleans, Plaquemines Parish, Louisiana	None Found	N/A
Smith and Weed 2003	Phase I Cultural Resource Investigations, Harvey Boulevard Extension, Jefferson and Plaquemines Parishes, Louisiana	None Found	N/A
Stanton et al. 2004	Intensive Cultural Resources Survey of the Peters Road Extension, Engineers Road to Louisiana Highway 23, Plaquemines and Jefferson Parishes, Louisiana	None Found	N/A
URS 2007	Preparation of Design Alternative Study for the Westbank and Vicinity Hurricane Protection Project, GIWW Navigable Closure Structure Alternatives, 95% Submittal	None Found	N/A

N/A-Not Applicable

Background research was consulted to determine what work if any had been conducted in the project area in Jefferson Parish (see table 4-18). Of the 38 archaeological surveys previously conducted in and around the project area, only one cultural resource was found within the project APE. Three potentially eligible standing structures were noted in a report by URS (2007) for a design plan for the GIWW Navigable Closure Structure alternatives for the HSDRRS WBV. Only one of the structures, 425 Planters Canal Road, falls within the project area. No photos or evaluations were presented. No other NRHP-eligible properties, archaeological sites, or standing structures are known within the project area.

A reassessment of the structure at 425 Planters Canal found that the structure is actually located at 415 Planters Canal. While the original portion of the house appears to have construction dates between the late 18th and the early 19th century, there have been additions and updates to the structure. Access to the interior of the structure could not be secured, so construction techniques are unknown the structure dates cannot be confirmed based on appearance. The structure may have been moved to its present location, because it could not be located on a historic map in its current location before 1935. Despite the question of its original location, the structural modification of the addition and the modern windows has rendered this property ineligible for the NRHP. As a result of this survey, no other archaeological sites or standing structures eligible for inclusion on the NRHP were identified (Wells 2008a, 2008b, 2008c, 2008d, Kelley 2008).

Plaquemines Parish

A portion of IER #12 is located within Plaquemines Parish. The APE of IER #12 measures approximately 35 miles in length and generally extends 500 ft on both sides of the levee. A gate option expanded that 500 ft boundary to a larger size in its vicinity. The APE of IER #13 measures approximately 4.3 miles in length and extends from the Mississippi River Levee and Oakville to Hero Canal levee before continuing west along the original alignment for another 3.15 miles. The width of the APE varies between 65 ft and 1,000 ft. An emergency evacuation route located just outside of the main APE measures 0.4 mile long. The APE of IER #13 was later amended to include various parcels outside the contiguous APE for use as staging areas and ROWs.

Background research was conducted to determine whether previous surveys had been completed within the project area in Plaquemines Parish (see table 4-18). Originally recorded by Gagliano (1975) in the course of a survey to assess impacts resulting from the dredging and spoil disposal along the GIWW, sites 16PL40 and 16PL41 were the only recorded sites within the current project area. Described as shell scatters along the bankline, these sites were reinvestigated by Hinks et al. (1991) and found to be secondary in context and subsequently determined as ineligible for the NRHP. No other NRHP-eligible properties, archaeological sites, or standing structures are known within the project area.

During the current field work, one archaeological site was identified within the current APE. Site 16PL169, the Mahoney-Crouere Site, is a historic shell midden restricted to the surface and top 4 inches below surface dating between the mid-19th and late 20th century. No deeper deposits were identified, and no intact subsurface features, such as privy deposits, were found within the site boundaries. Site 16PL169 has been assessed as ineligible for the NRHP because of the poor integrity and low research potential. A previously recorded site, 16PL115 (Idlewild Plantation), is located immediately south of the APE. Phase I investigations were undertaken to determine the extent and boundaries of the site. 16PL115 represents a historic scatter, approximately 213 ft by 213 ft; however, rights of entry did not allow survey of the southern boundary of the site. Artifacts were found mostly on the surface and appear to date from the early 19th century through the late 19th or early 20th century. A minimal component of the site dates to the late 18th century. Phase II NRHP eligibility testing was not conducted because 16PL115 falls outside of the APE. In order to protect this site from construction impacts, a no-work zone was placed around this

resource. No other sites were found within the project area (Coastal Environments, Inc. 2007, Coastal Environments, Inc. 2009, and Wells 2008a).

Borrow Area

A total of 66 borrow areas throughout southeast Louisiana and in Hancock County, Mississippi, were investigated as part of the HSDRRS project (table 4-19). The following discussion does not include those borrow areas with no known cultural resources.

St. Charles Parish

Bonnet Carré North borrow area is a 680-acre parcel located between the Mississippi River and Airline Highway (US 61). Background information on land use and geomorphology suggests a low probability for cultural resources. No known archaeological sites or NRHP-eligible properties are located within the parcel; however, current conditions at the borrow area made testing impractical. While no known cultural resources were present within the APE for Bonnet Carré Spillway North borrow area, a cultural resources examination could not be conducted at the area because of periodic river flooding, standing water at some locations, and depth of sediments from periodic deposition during spillway openings. A plan for archaeological monitoring at the Bonnet Carré North borrow area was enacted during the soil extraction process.

The 3C Riverside Phase III Borrow Area is located near the town of Killona on the west bank of the Mississippi River. The portion within natural levee deposits located at a higher elevation were evaluated as a high probability area for cultural resources, while those areas at a lower elevation contain poorly drained soils and were evaluated as having low potential for cultural resources. No known eligible cultural resources and no NRHP properties exist within the APE of 3C Riverside Phase III. Site 16SC85 and standing structure 3C-HSS-01 were identified in the APE of the 3C Riverside Phase 3 Borrow Area. Investigations found that neither site 16SC85 nor structure 3C-HSS-01 possessed the qualities necessary for listing on the NRHP, and both were determined ineligible. No further research is needed for 3C Riverside Phase III or 3C Riverside (Sites 1 and 2).

Jefferson Parish

No archaeological sites or standing structures eligible for the NRHP were found in the Westbank E Phase I Borrow APE or in the Westbank E Phase II Borrow APE. The remains of a sugar mill were found in the area investigated for Westbank E. A no-work zone was placed around the sugar mill remains in order to preserve this cultural resource in place when the borrow area is excavated.

Churchill Farms Pit A is located south of US 90 in Jefferson Parish and lies within a drained backswamp area that is prone to flooding. Background research determined that there were no known eligible archaeological sites or standing structures within the APE of the borrow area; however, a cultural resources survey was conducted. Due to the low probability of cultural resources in the area and the disturbed appearance of the surface, no new archaeological sites or standing structures eligible for the NRHP were found during the survey in the Churchill Farms Pit A Borrow APE.

Concern was expressed by the THPO of the Mississippi Band of Choctaw Indians over the sparseness of the shovel tests in and around the borrow area. The THPO requested that profiles of the geotechnical borings be included in the report as well. In response to the THPO, the USACE provided the report revisions and enacted a monitoring plan for the soil extraction process at Churchill Farms Pit A (Hughbanks 2011a), which is discussed in more detail in section 5.0.

Table 4-19. Borrow Area Cultural Survey Results Within and Outside of the HSDRRS

Parish/County	Borrow Area	Sites within APE	Eligibility	Impact Statement	
St. Charles	Bonnet Carre Spillway (North)	None Known; Site condition not suitable for archaeological testing.	N/A	Archaeological monitoring of soil extraction process.	
	3C Riverside (Sites 1 and 2)	None	N/A	No Known Impacts	
	3C Riverside Phase III	16SC85	Ineligible	No Known Impacts	
		Standing Structure #3C-HSS-01	Ineligible	No Known Impacts	
	Churchill Farms Pit A	None	N/A	Archaeological monitoring of the soil extraction process.	
	Westbank Site G	None	N/A	No Known Impacts	
	River Birch Phase I	None	N/A	No Known Impacts	
	River Birch Phase II	None	N/A	No Known Impacts	
	River Birch Landfill Expansion	None	N/A	No Known Impacts	
	Westbank F	None	N/A	No Known Impacts	
Westbank I	None	N/A	No Known Impacts		
Jefferson	Westbank E Phase I	Historic Sugar Mill (No Site #)	Unknown	Placement of a protective buffer zone around sugar mill avoided impacts.	
	Westbank E Phase II	None	N/A	No Known Impacts	
	Westbank D	None	N/A	No Known Impacts	
	South Kenner Road	None	N/A	No Known Impacts	
	Willswood	None	N/A	No Known Impacts	
	Westbank F (Access Corridor)	None	N/A	No Known Impacts	
	Maynard	None	N/A	No Known Impacts	
	Cummings North 2	None	N/A	No Known Impacts	
	Eastover Phase I	None	N/A	No Known Impacts	
	Eastover Phase II	None	N/A	No Known Impacts	
Orleans	Stumpf Phase I	None	N/A	No Known Impacts	
	Stumpf Phase II	None	N/A	No Known Impacts	
	1418/1420 Bayou Road	None	N/A	No Known Impacts	
	1572 Bayou Road	None	N/A	No Known Impacts	
	910 Bayou Road	None	N/A	No Known Impacts	
	4001 Florissant	None	N/A	No Known Impacts	
	Dockville	None	N/A	No Known Impacts	
	Sylvia Guillot	None	N/A	No Known Impacts	
	St. Bernard	1418/1420 Bayou Road	None	N/A	No Known Impacts
		1572 Bayou Road	None	N/A	No Known Impacts
910 Bayou Road		None	N/A	No Known Impacts	
4001 Florissant		None	N/A	No Known Impacts	
Dockville		None	N/A	No Known Impacts	
Sylvia Guillot		None	N/A	No Known Impacts	
1418/1420 Bayou Road		None	N/A	No Known Impacts	
1572 Bayou Road		None	N/A	No Known Impacts	
910 Bayou Road		None	N/A	No Known Impacts	
4001 Florissant		None	N/A	No Known Impacts	

Table 4-19, continued

Parish/County	Borrow Area	Sites within APE	Eligibility	Impact Statement
St. Bernard (continued)	Gatien-Navy Camp Hope	None in APE, Merrick Cemetery is located at the northeastern boundary.	N/A	Placement of protective buffer zone around Merrick Cemetery avoided impacts on this cemetery.
	DK Aggregates	None	N/A	No Known Impacts
	Acosta	None	N/A	No Known Impacts
	1025 Florissant	None	N/A	No Known Impacts
	Johnson/Crovetto	None	N/A	No Known Impacts
		16SB160	Ineligible	No Known Impacts
		16SB162	Ineligible	No Known Impacts
		16SB163	Ineligible	No Known Impacts
		16SB164	Eligible	Placement of a 200 ft protective buffer zone was placed around 16SB164 to avoid impacts.
		16SB165	Eligible	Placement of a 200 ft protective buffer zone was placed around 16SB165 to avoid impacts.
Plaquemines	Contreras Dirt (Cells E, F, and Z)	16SB157	Ineligible	No Known Impacts
		16SB158	Ineligible	No Known Impacts
		16SB159	Ineligible	No Known Impacts
	Acosta 2	None	N/A	No Known Impacts
	Spoil Area	None	N/A	No Known Impacts
	Belle Chasse	None	N/A	No Known Impacts
	Triumph	None	N/A	No Known Impacts
	Kimble #2	16PL104	Ineligible	No Known Impacts
	Brad Buras	None	N/A	No Known Impacts
	Tabony	None	N/A	No Known Impacts
Westbank N	None	N/A	No Known Impacts	
Myrtle Grove	None	N/A	No Known Impacts	
Tac Carre	None	N/A	No Known Impacts	
Meyer	None	N/A	No Known Impacts	
Bazile	None	N/A	No Known Impacts	
Scarsdale	None	N/A	No Known Impacts	

Table 4-19, continued

Parish/County	Borrow Area	Sites within APE	Eligibility	Impact Statement	
Plaquemines, continued	Citrus Lands	16PL157 (3 new loci)	2 loci ineligible, 1 locus potentially eligible.	A 328 ft protective buffer zone was placed around the potentially eligible locus.	
		16PL153	Potentially Eligible	A 328 ft protective buffer zone was placed around 16PL153 to avoid impacts on the site.	
		16PL165	Unknown	A 328 ft protective buffer zone was placed around 16PL165 to avoid impacts on the site.	
	Conoco Phillips	Idlewild Stage 1	16PL170 (3 new loci)	All Ineligible	No Known Impacts
		Idlewild Stage 2	16PL170 (3 new loci)	All Ineligible	No Known Impacts
		Nairn	None	N/A	No Known Impacts
Plaquemines Dirt & Clay		16PL153	Potentially Eligible	A 328 ft protective buffer zone was placed around 16PL153 to avoid impacts on the site.	
		16PL157 (3 new loci)	All Ineligible	No Known Impacts	
		16AN82	Eligible	A 200 ft protective buffer zone was placed around 16AN82 to avoid impacts on the site.	
Ascension	Bocage	Historic Sugar Mill (No Site #)	Eligible	A 200 ft protective buffer zone was placed around the historic sugar mill remains to avoid impacts on the site.	
		None	N/A	No Known Impacts	
		None	N/A	No Known Impacts	
Iberville	St. Gabriel Redevelopment	None	N/A	No Known Impacts	
		Big Shake	N/A	No Known Impacts	
		Willow Bend	N/A	No Known Impacts	
St. John the Baptist	Willow Bend II	16SJB14	Eligible (Research exhausted)	No Known Impacts	
		16SJB15	Unknown	A 290 ft protective buffer zone was placed around 16SJB15 to avoid impacts on the site.	
St. Tammany	Tammany Holding Levis	None	N/A	No Known Impacts	
		None	N/A	No Known Impacts	

Table 4-19, continued

Parish/County	Borrow Area	Sites within APE	Eligibility	Impact Statement
Hancock County, Mississippi	Pearlington Dirt Phase I	None	N/A	No Known Impacts
	Pearlington Dirt Phase II	None	N/A	No Known Impacts
	Frierson	None	N/A	No Known Impacts
	Henley	None	N/A	No Known Impacts
	King Mine	None	N/A	No Known Impacts
	Port Bienville	None, Concern for unrecorded Burials	N/A	A Memorandum of Agreement (MOA) between owner and tribes*
Lafourche	Raceland Raw Sugar	None	N/A	No Known Impacts
East Baton Rouge	Lilly Bayou	16EBR201	Ineligible	No Known Impacts
		16EBR202	Ineligible	No Known Impacts
		16EBR203	Ineligible	No Known Impacts

*MOA signed in Mississippi between the Jena Band and the Mississippi Band of Choctaws Indians and M. Matt Durand, L.L.C. of Port Bienville Clay and Mine, L.L.C. The MOA outlines the procedures that will be followed during excavation and in the event of identification of unrecorded burials.
N/A-Not Applicable

St. Bernard Parish

The Gatién-Navy Camp Hope Borrow Area was found to have no known eligible archaeological sites or standing structures within the APE identified during previous surveys. No new archaeological sites or standing structures eligible for the NRHP were found in the Gatién-Navy Camp Hope Borrow APE. While no cultural resources were found within the borrow area APE, Merrick Cemetery is located on the northeastern boundary of Gatién-Navy Camp Hope. A plan has been developed to create a no-work zone between the Borrow Area and the Cemetery, which would avoid impacts on the neighboring cemetery.

The Contreras Dirt Borrow Area consists of three locations: Cell E, Cell F, and Cell Z. In previous surveys it was determined that two of these three parcels were found to have no known eligible archaeological sites or standing structures within the APE of the borrow area. Cell F held a single known site, 16SB160. However, for the HSDRRS project requirements, separate Phase I Archaeological Surveys were conducted for each parcel within the Contreras Dirt Borrow Area.

For Cell E, four new archaeological sites, and four new non-site loci were identified. Site 16SB162 is a multiple component site with artifacts dating from the 18th through the 20th centuries. The integrity of the deposits is low and indicates mixing. Site 16SB163 is a light surface scatter consisting of 20th century artifacts. Both 16SB162 and 16SB163 were considered ineligible for listing on the NRHP. Site 16SB164 is the archaeological remains of the Contreras Plantation. This site is located on both sides of Bayou Road, and includes a concrete marker and small park area. One of the components of this site was a surface scatter with corresponding subsurface deposits. Site 16SB164 has been determined eligible for listing on the NRHP. Site 16SB165 is a low-density artifact scatter with shallow subsurface deposits. Artifacts were from the 18th and 19th century and appear to be clustered temporally within the site boundary. This site has been determined eligible for listing on the NRHP. To avoid impact on these eligible sites, a 200 ft no-work zone was placed around 16SB164 and 16SB165.

Within Cell F, the Phase I cultural resource survey identified one archaeological site, 16SB157, and one historic locus, B-02. A previously recorded site, 16SB160, the abandoned New Orleans and Southern Railroad Grade, lies in the north part of this parcel. Sites 16SB160 and 16SB157 were found to have low integrity and were determined ineligible for listing on the NRHP. Locus B-02 did not possess the qualities for an archaeological site.

Within Cell Z, two separate Phase I surveys were conducted within its boundaries, and two new archaeological sites and one non-site locus were identified. Site 16SB158 consisted of a low-density surface scatter and shallow deposits of brick fragments. Site 16SB159 represents a late 19th to early 20th century rubbish pile. No intact subsurface deposits were found. Neither site 16SB158 nor site 16SB159 was found to be eligible for listing on the NRHP. The non-site locus found within Cell Z was an isolated find and did not meet the criteria for an archaeological site.

Plaquemines Parish

After a Phase I archaeological survey, three new loci associated with the nearby NRHP-listed Woodland Plantation (16PL157) were found in the Citrus Lands borrow APE. Two of the three new loci were found to be ineligible and non-contributing factors of Woodland Plantation. The third of the new loci was considered potentially eligible as a contributing element of Woodland Plantation, and further research was recommended. In order to avoid impacts on this contributing element, a 328 ft no-work zone would be placed around this resource.

There is one known archaeological site, 16PL153, that is located on the edge of the proposed Conoco Phillips borrow area and is also on the edge of Plaquemines Dirt and Clay Borrow Area. A 328 ft no-work zone has been placed around this site to protect it from impacts. Another previously recorded site, 16PL165, within the proposed borrow area was revisited in order to

determine its current condition. The survey found that 16PL165 should have further research conducted to evaluate its eligibility for the NRHP. To avoid impacts on this site, a 328 ft no-work zone would be placed around 16PL165. No new archaeological sites or standing structures eligible for the NRHP were found in the Conoco Borrow APE.

During the current Phase I archaeological survey, three new loci associated with nearby Sarah Plantation (16PL170) were identified within the APE of the Idlewild Stage 1 borrow area. These three loci were evaluated and found ineligible for the NRHP, and no further work is necessary.

There is one known archaeological site from previous surveys, 16PL153, that is located on the edge of the Plaquemines Dirt and Clay borrow area and is also on the edge of the proposed Citrus Lands Borrow Area. A 328 ft no-work zone was placed around this site to protect it from impacts. The HSDRRS Phase I archaeological survey also identified three new loci associated with the NRHP-listed Woodland Plantation (16PL157). These three loci were found to be ineligible as a contributing element of Woodland Plantation. No further research was required.

Ascension Parish

Bocage borrow area is located approximately 950 ft north of the Bocage Plantation House, which was built in 1801 and renovated to the Greek Revival Style in 1840, and is listed on the NRHP. Although historic maps show associated structures, no historic structures currently stand in the borrow area APE. Within the proposed borrow area, two historic sites have been identified and recorded: Site 16AN82, the Bocage Plantation Quarters site, and the structural remains of a historic period sugar mill. A 200 ft no-work zone would be placed around these cultural resources in order to protect these sites from impact.

Site 16AN82, the Bocage Plantation Quarters site, contains intact cultural deposits associated with 19th and 20th century slave quarters/tenant farmer houses. This site has been determined eligible for NRHP listing (Shuman 2009). The site of the sugar house structural remains does not lie in the proposed borrow area, and was not investigated by Shuman (2009); however, it is clearly associated with sugar production at Bocage Plantation and is considered eligible for listing on the NRHP.

St. John the Baptist Parish

Two borrow areas were located south of River Road within St. John the Baptist Parish; Willow Bend Pre-Approved contractor-furnished borrow area and Willow Bend Phase II contractor-furnished borrow area.

Willow Bend was originally investigated in 1979 (McIntire) and more recently by Rawls and Smith (2008). No known archaeological sites or historic standing structures were identified within the borrow area APE, and no new sites were discovered by Rawls and Smith (2008). Within 2,000 ft of the Willow Bend borrow area, three probable sugar mills were discovered. A 400 ft no-work zone was placed around these cultural resources to protect them. The borrow area does not extend into or intersect with these buffer zones.

Willow Bend Phase II lies partially within backswamp land, and partially on the natural levee. A Phase I survey of the borrow area was conducted and identified the remains of two sugar mills on the property, 16SJB14, the Shell Road Site, and 16SJB15, Wego Plantation. The sites were originally considered to be ineligible by McIntire (1978); however, based on the date of the last survey and the loss of numerous sugar mills around Louisiana, the SHPO requested that additional surveys be performed to update the site conditions.

Site 16SJB14, or the Shell Road Site, was originally documented in 1979 (McIntire) and revisited in 2008 (Rawls and Smith). The revisit of this site led to a recommendation for avoidance or evaluation of this site. Excavations to determine eligibility of the Shell Road Site

were conducted by Martin et al. (2008). This research revealed that the sugar mill began in the 1830s or 1840s using open-kettle processing. The sugar mill later changed production from open kettle to steam apparatus. Martin et al. (2008) assessed the site as eligible for the NRHP because of intact deposits and features that clearly represent a small sugar mill dating to the antebellum era and that also show the transition from old to new processes. While 16SJB14 may be eligible for the NRHP, it should be noted that this Phase II archaeological survey has exhausted the research potential of the site. With no data remaining to be obtained, there will not be an adverse effect on this site if the current project is continued. Martin et al. (2008) does, however, recommend archaeological monitoring of any ground-disturbing activities between 16SJB14 and the Mississippi River.

Site 16SJB15, Wego Plantation was revisited by Rawls and Smith (2008). The updated survey found Site 16SJB15 to be of unknown status, and further research was recommended if the site would be impacted. As a precaution, a no-work zone of 290 ft was placed around Wego Plantation in order to protect this cultural resource in situ.

East Baton Rouge Parish

A Phase I cultural resources survey at Lilly Bayou borrow area identified three new archaeological sites. Site 16EBR201 is a prehistoric site related to the Coles Creek period (AD 700 to 1200). Site 16EBR202 is a prehistoric site (probably Coles Creek) with a more recent historic component. Site 16EBR203 is the remains of a 20th century structure. All of these sites were deemed ineligible for the NRHP.

Hancock County, Mississippi

A Phase I cultural resources survey was conducted for the APE of Port Bienville borrow area. No archaeological sites or standing structures eligible for the NRHP were identified. The Jena Band of Choctaws and the Mississippi Band of Choctaws raised concerns over the possibility of unmarked and unrecorded burials within the project APE. Because of these concerns, an MOA has been signed between the tribes and M. Matt Durand, L.L.C. of Port Bienville Clay Mine, L.L.C. This MOA outlines the procedures for the excavation of the borrow pit and the treatment for any unmarked burials should they be found.

4.2.9.2 Impacts of HSDRRS

4.2.9.2.1 HSDRRS 2011 Impacts

The USACE held meetings with the Louisiana SHPO staff and THPOs to discuss the NEPA Alternative Arrangements project review and the development of a Programmatic Agreement (PA) to tailor the Section 106 consultation process under the NEPA Alternative Arrangements. The USACE formally initiated Section 106 consultation for the LPV component (100-year) and the WBV component (100-year) of the HSDRRS in a letter dated April 9, 2007. This letter emphasized that standard Section 106 consultation procedures were implemented during PA development. The PA required that USACE develop predictive models for each HSDRRS APE activity area delineating the potential (low or high) for historic properties meeting the criteria for eligibility for the NRHP (36 CFR 60). These predictive models were to be developed by architectural historians, historians, and archaeologists who possess the professional qualifications established by the Secretary of the Interior (36 CFR Part 61). Based on the results of these models, USACE would provide the following:

1. Public Interpretation
2. Documentation consistent with the Level II Standards of the Historic American Building Survey/ Historic American Engineering Record
3. Historical, architectural, or archaeological monographs

4. Rehabilitation of historic buildings in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68)
5. Off-site mitigation, including acquisition of property or preservation easements on property, as appropriate, containing threatened resources of comparable significance in circumstances where there is an imminent need to proceed with construction activity and it is in the public interest

However, the PA was never executed. Instead, standard Section 106 consultation procedures were determined to be suitable for all HSDRRS actions and were used throughout the consultation process.

In letters sent to the Louisiana SHPO and THPO of the 12 Federally recognized tribes with an interest in the region, the USACE provided project documentation, evaluated cultural resources potential in the project area, and found that the HSDRRS actions had no impact on historic properties with the implementation of the USACE mitigation measures (table 4-20). Section 106 consultation for the HSDRRS projects was then concluded. However, if any unrecorded cultural resources were determined to exist within the project boundaries, then no work proceeded in the area containing these cultural resources until a USACE archaeologist was notified and final coordination with the SHPO and Indian Tribes was completed.

Table 4-20. Cultural Resources Impacts Within and Outside of the HSDRRS

Parish/County	Sites in or Adjacent to APE	Impacts	USACE Mitigation
St. Charles	Bonnet Carre Spillway (North)	No known impacts with USACE mitigation implementation.	Archaeological monitoring of the soil extraction process.
Jefferson	Historic Sugar Mill (Near the Westbank E Borrow Area APE)	No known impacts with USACE mitigation implementation.	Placement of a no-work zone around the historic sugar mill.
	Churchill Farms Pit A	No known impacts with USACE mitigation implementation.	Archaeological monitoring of the soil extraction process.
Orleans	Fort St. John/Spanish Fort 16OR19	Unauthorized usage of site as a staging area. Equipment, dirt, and concrete debris placed on top of the cultural resource. Site was originally mitigated through a no-work zone.	USACE Archaeologists monitored the removal of equipment and debris. Fencing placed around the cultural resource to prevent confusion of its boundaries.
	Milneburg Lighthouse	No known impacts with USACE mitigation implementation.	Placement of a no-work zone of 150 ft around the resource.
	16OR448	No known impacts with USACE mitigation implementation.	Placement of a no-work zone around the resource.
	16OR97	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	16OR449	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.

Table 4-20, continued

Parish/County	Sites in or Adjacent to APE	Impacts	USACE Mitigation
	16OR450	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	16OR451	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	16OR452	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	Target 28-4	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	Target 29-1	No known impacts with USACE mitigation implementation.	Placement of a 350 ft no-work zone around the resource.
	Target 37-1	No known impacts with USACE mitigation implementation.	Placement of a no-work zone around the resource.
St. Bernard	Merrick Cemetery	No known impacts with USACE mitigation implementation.	Placement of a no-work zone between the cemetery and the Gatién-Navy Camp Hope borrow area.
	16SB164	No known impacts with USACE mitigation implementation.	Placement of a 200 ft no-work zone around 16SB164 avoided impacts on the site.
	16SB165	No known impacts with USACE mitigation implementation.	Placement of a 200 ft no-work zone around 16SB165 avoided impacts to the site.
	16SB84	No known impacts with USACE mitigation implementation.	Placement of a 350 ft radius no-work zone around 16SB84 avoided impacts on the site.
	16SB161	No known impacts with USACE mitigation implementation.	Restriction of ground-disturbing activities within the vicinity of the site to an area 400 ft from the levee centerline.
Plaquemines	Contributing locus of nearby 16PL157	No known impacts with USACE mitigation implementation.	Placement of a 328 ft no-work zone around the locus avoided impacts on the site.
	16PL115	No known impacts with USACE mitigation implementation.	Placement of a no-work zone around 16PL115 avoided impacts on the site.
	16PL153	No known impacts with USACE mitigation implementation.	Placement of a 328 ft no-work zone around 16PL153 avoided impacts on the site.
	16PL165	No known impacts with USACE mitigation implementation.	Placement of a 328 ft no-work zone around 16PL165 avoided impacts on the site.

Table 4-20, continued

Parish/County	Sites in or Adjacent to APE	Impacts	USACE Mitigation
Impacts outside of HSDRRS			
Ascension	16AN82	No known impacts with USACE mitigation implementation.	Placement of a 200 ft no-work zone around 16AN82 avoided impacts on the site.
	Historic Sugar Mill Remains	No known impacts with USACE mitigation implementation.	Placement of a 200 ft no-work zone around the historic sugar mill avoided impacts on the site.
St. John the Baptist	16SJB15	No known impacts with USACE mitigation implementation.	Placement of a 290 ft no-work zone around the historic sugar mill avoided impacts on the site.
Hancock County, MS	None found, but concern for unmarked tribal burials in APE	No known impacts with USACE mitigation implementation.	Signed MOA between tribes and Port Bienville Clay Mine, L.L.C.

Implementation of the HSDRRS projects had beneficial indirect impacts by providing an added level of flood risk reduction to known and unknown archaeological sites in the project vicinity on the protected side of the levees, thereby reducing the damage caused by flood events. Erosion of ground deposits during flood events can result in severe damage and destruction of archaeological sites.

In May 2010, contractors apprised the USACE of the need to utilize an existing road that passed through the Willow Bend Borrow Area. The road was needed as a haul road for heavy truck traffic that was expected with the borrow activities in the pit, and at issue was that the road passed through a no-work zone that was established for known cultural resource 16SJB15. This buffer zone was established in IER #19 and had been coordinated as part of Section 106 activities with the SHPO and interested THPOs.

The USACE project archaeologists visited the site and performed a pedestrian reconnaissance survey at Site 16SJB15 and along the existing road to determine if further use of the road would damage any known or unrecorded portions of the cultural resource. It was determined that this road had seen heavy use in the past and was elevated above the natural ground surface. It was determined that no cultural artifacts were located immediately adjacent to the road that might indicate the presence of unrecorded cultural activity below the existing road.

A new letter of coordination was then mailed to the SHPO, dated June 4, 2010. The conclusion was presented to allow an exception to the no-work zone for utilization of the haul road, which did not damage site 16SJB15. The SHPO responded in a letter dated June 24, 2010, with no objection to the redefinition of the no-work zone for this purpose (Hughbanks 2011b).

In August of 2010 it was realized that a staging area for the floodwall construction work on the east side of Bayou St. John at the control structure had been established outside of the boundaries authorized for such in Construction P&S review and construction documents. This unauthorized staging area overlapped boundaries for a cultural resource recorded during standard legally required cultural resources survey in the planning stages of the HSDRRS work specific to this project.

The boundary for the staging area had been established to aid in project deadlines. The cultural resource was not fully assessed for NRHP significance and eligibility, as to do so would have

caused a potential delay in the construction schedule. Therefore the boundary for the no-work zone was created to both allow the construction schedule to proceed, and to protect the cultural resource, as legally required for all Federally funded projects.

The infraction of boundaries allowed heavy equipment and some amount of dirt and concrete debris to be placed over the cultural resource. The cultural resource was known to be very shallow below the modern surface, and so potential to harm the cultural resource did exist if the staging area continued to be used.

After work ceased and a new staging area boundary was established, the USACE project archaeologists oversaw the removal of equipment and debris from the unauthorized area and protection of the potentially fragile cultural resource directly below the surface.

In coordination with contract construction personnel and with the USACE inspectors, movement of materials was scheduled and supervised. Days of dry weather were picked to minimize inevitable impact on the ground surface from wheels or tracked machinery. The lightest and most efficient equipment was used, in order minimize further damage to the ground surface and the cultural resource below it. The USACE project archaeologists were present at each of these episodes to observe if deep ruts were created or if any cultural artifacts were disturbed as visible from the surface above.

Despite some inevitable delays and rescheduling due to weather or other priorities for necessary equipment on-site, all unauthorized debris and equipment were removed from the cultural resource area. The USACE project archaeologists inspected the area, and there were no signs that cultural artifacts were disturbed. A fence remained in place to properly show the authorized vs. unauthorized boundary for the staging area (Hughbanks 2011c).

The remote sensing survey identified several submerged NRHP-eligible shipwrecks within the APE of the HSDRRS. Placement of no-work areas around these historic properties resulted in no direct impacts on these submerged cultural resources. All other project APE areas were surveyed and found to contain no cultural resources eligible for the NRHP. Implementation of the HSDRRS had beneficial impacts on cultural resources.

Erosion of ground deposits during flood events can result in severe damage and destruction of archaeological sites. Implementation of the HSDRRS had beneficial indirect impacts by providing an added level of flood risk reduction to known and unknown archaeological sites in the project vicinity within the protected side of the levees by reducing the damage caused by storm events. However, if any unrecorded cultural resources were determined to exist within the project boundaries, then no work proceeded in the area containing these cultural resources until a USACE archaeologist was notified and final coordination with the SHPO and Indian Tribes was completed.

All IER and IER Supplemental actions for the HSDRRS are committed to minimizing any potential for cultural resource impacts by the USACE through the Section 106 process. Additionally, most IERs stated that if any unrecorded cultural resources were determined to exist within the project boundaries, then no work proceeded in the area containing these cultural resources until a USACE-PDN-NCR archaeologist was notified and final coordination with the SHPO and THPO was completed (USACE-PDR-RN/SHPO Standard Operating Procedure). More detailed mitigation measures can be found in section 5.2.

4.2.9.2.2 HSDRRS 2057 Impacts

Future levee lifts would most likely occur within the present HSDRRS project area; however, future levee lifts could require expanded levee footprints and expanded ROWs. Should the construction require a larger ROW, or new borrow areas, Section 106 would need to be reinitiated in order to determine the existence of known cultural resources eligible for the NRHP within the expanded APE, and to determine if the entire expanded APE has been subjected to a cultural resources survey. The potential for impacts would be negligible as all impacts on cultural resources would be minimized through the Section 106 process. If areas within the APE have not been surveyed, Phase I or Phase II cultural investigations would be necessary.

4.2.9.3 Cumulative Impacts

4.2.9.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Section 106 consultation has been completed and all required mitigation measures have been implemented for cultural resources in the HSDRRS project area. No adverse impacts on cultural resources occurred; further, any future HSDRRS activities would also require the successful completion of Section 106, and mitigation for any potential adverse effects on potentially eligible historic properties. Therefore, there would be no adverse cumulative impacts on cultural resources from the HSDRRS.

4.2.9.3.2 Cumulative Impacts of Present and Future Regional Actions

Projects controlled by, and projects that acquire their funds from, Federal sources are subject to Section 106 guidelines and processes under the NHPA. Under these laws, the Federal entity is required to consider the effects of their projects upon cultural resources. It is the duty of the Federal entity to identify and evaluate all cultural resources within a project area, as well as to provide this information to the SHPO and tribal governments for review and comment on all cultural resources within the APE. Cultural resources or historic properties include any prehistoric or historic district, archaeological site, structure, or object included or eligible for listing on the NRHP. All Federal flood risk reduction, coastal and wetland restoration, and transportation projects are subject to these guidelines and processes, and therefore such Federal projects should not cumulatively adversely impact cultural resources.

Storm Damage Reconstruction and Redevelopment

Storm damage reconstruction and redevelopment projects in the region, in general, would not require cultural resource surveys because these projects will be using an existing footprint that may or may not have been previously surveyed. There is the potential for adverse effects on potentially eligible historic properties as a result of reconstruction and redevelopment of properties, and permanent cumulative impacts on cultural resources would occur. In southeast Louisiana, many of the properties likely to be adversely impacted by these types of projects contain historic structures, and zoning requirements in some urban areas would potentially reduce the level of cumulative impacts by requiring reconstruction and redevelopment projects to follow specific architectural guidelines.

4.2.9.3.3 Summary of All Cumulative Impacts for Cultural Resources

While many cultural resource surveys have been conducted within the project APE, future and concurrent regional projects still have the potential to adversely affect cultural resources by the destruction of all or part of eligible archaeological sites, modification of historic structures, or alteration of the viewshed of historic districts. However, for Federal projects, if any unrecorded cultural resources are determined to exist within a project's boundaries, then no work will proceed in the area containing these cultural resources until the SHPO has been notified. As

such, other Federal current and future regional projects would potentially have minor direct and indirect cumulative adverse impacts on cultural resources.

4.2.10 Recreational Resources

4.2.10.1 Affected Environment

This resource is institutionally significant because of the Federal Water Project Recreation Act of 1965 (P L 89-72), as amended, and the Land and Water Conservation Fund Act of 1965 (P L 88-578), as amended. Recreational resources are technically significant because of the high economic value of recreational activities and their contribution to local, state, and National economies. Recreation resources are publicly significant because the public's utilization of parks, outdoor spaces, and other leisure activities improves quality of life and community interactions.

Visitor spending at Louisiana State Parks returns \$3.23 in state taxes for every dollar spent on operating and maintaining the parks (Louisiana Department of Culture, Recreation and Tourism [DCRT] 2009a). Two state parks and one wildlife management area are located in the HSDRRS project area – Bayou Segnette State Park, St. Bernard State Park, and Biloxi Wildlife Management Area. Bayou Sauvage NWR is also located in the New Orleans East sub-basin. City Park, although on land owned by the City of New Orleans, is managed and maintained by the City Park Improvement Association, a unique state entity of the DCRT. Other large outdoor recreational areas include the Bonnet Carré Spillway, Williams Boulevard Park, Linear Park, Lakeshore Park, Municipal Yacht Harbor, Bayou Sauvage NWR, and Bayou Segnette State Park (figure 4-8).

The value the public places on recreational resources such as boating, fishing, and hunting can be directly measured by the large number of fishing and hunting licenses sold in Louisiana, and the large number of recreational boat registrations per capita. Many levee segments in the HSDRRS project area provide recreational opportunities for walking, running, and bicycling. Segments along Lake Pontchartrain in Jefferson and Orleans parishes are especially important components of outdoor recreation in the region.

Numerous water bodies in the region provide boating and fishing opportunities. Within the HSDRRS, Bayou St. John, a designated Louisiana Natural and Scenic River, provides canoeing and kayaking activities and Bayou Sauvage NWR provides areas for hunting, fishing, and bird watching. Lakes Pontchartrain, Borgne, and Cataouatche are used locally for recreational boating and fishing. Numerous boat launches in the region provide direct access to these estuarine water bodies (see figure 4-8).

The GIWW/MRGO/IHNC complex is used for fishing and recreational boat access to nearby bayous, canals, and estuaries. Bayou Bienvenue is a designated Louisiana Scenic River in St. Bernard Parish, and extends from the Lower Ninth Ward in Orleans Parish to Lake Borgne. Bayou Bienvenue is an important urban recreational resource that provides local fishing and boating opportunities for residents of St. Bernard Parish and the Lower Ninth Ward and Holy Cross neighborhoods. Bayou Bienvenue is also a component of the approximately 29,000-acre Central Wetlands Unit, which is bounded by the HSDRRS levees along the MRGO and GIWW on the north and east sides, and a local levee along the south side. Water levels in the Central Wetlands Unit are influenced by two tidal gates, one located on Bayou Bienvenue, and the other on Bayou Dupre, another designated Louisiana Natural and Scenic River.

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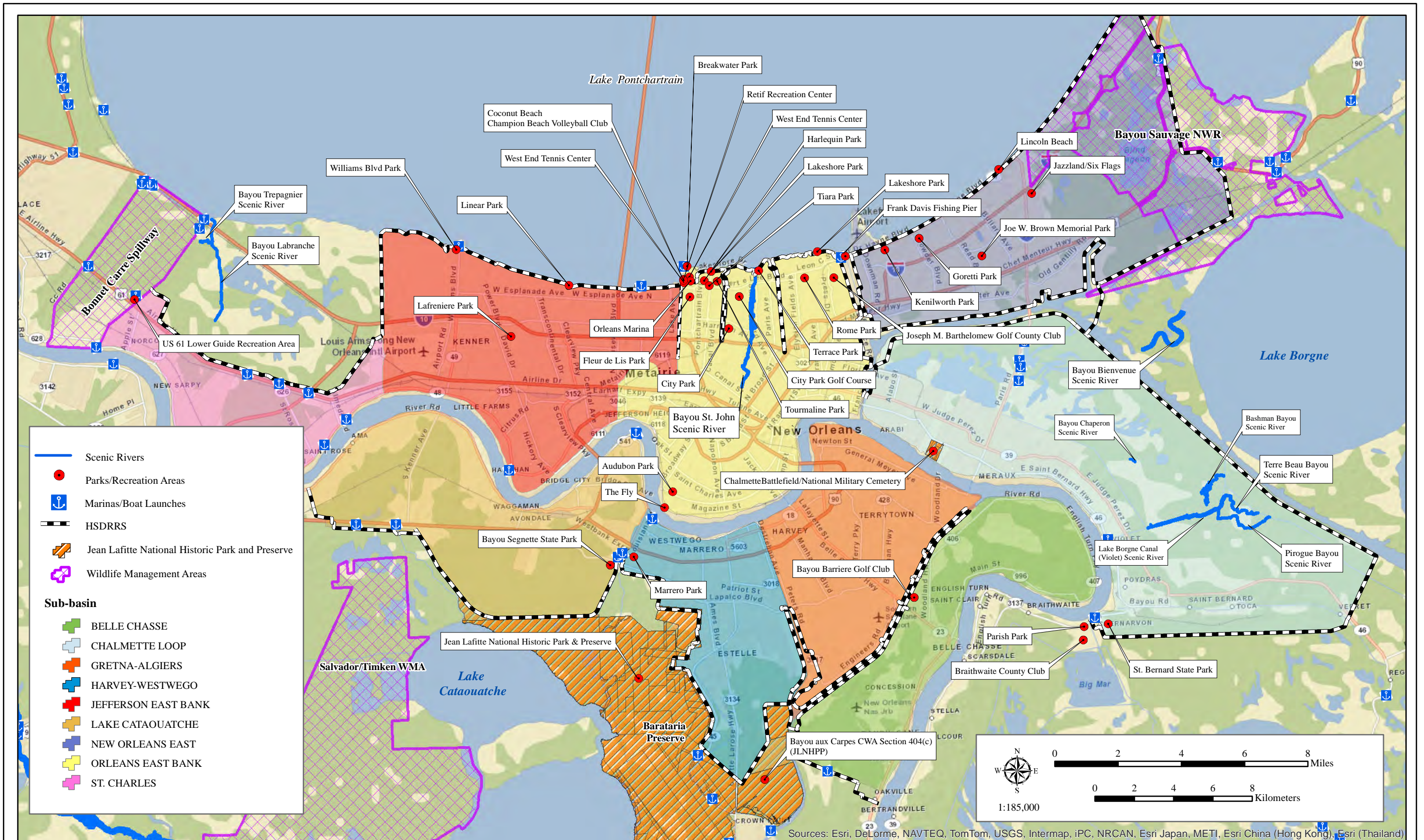


Figure 4-8: Recreational Areas within or near the HSDRRS

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There are no National Forests located within or near the HSDRRS project vicinity. There is one National Park, the Jean Lafitte National Historic Park and Preserve (JLNHPP), which includes various units that are within or near the project area: the Barataria Preserve (which now includes the Bayou Aux Carpes CWA Section 404(c) area), the Chalmette Battlefield and National Cemetery, and the French Quarter Visitor Center. One NWR (Bayou Sauvage), which is managed by USFWS, is located within the project area. Each of these sites located in or near the project area will be discussed in further detail.

The following sections discuss recreational resources within or adjacent to the sub-basins that contain the HSDRRS project corridor.

St. Charles Sub-basin

Recreational resources are primarily limited to activities such as fishing and hunting in the marshes located within this sub-basin and vicinity.

Jefferson East Bank Sub-basin

The Jefferson Parish Parks and Recreation Department maintains playgrounds and parks on both the East and West banks. Flooding and winds from Hurricanes Katrina and Rita caused substantial damage to many of these locally managed facilities, and some facilities have not yet been repaired.

Jefferson Parish Parks and Recreation Department also administers several recreational areas along Lake Pontchartrain, specifically Lafreniere Park, Linear Park, and Bonnabel boat launch. The 155-acre Lafreniere Park provides ball fields, a carousel and picnic area, a disc golf course, and the Foundation Center, a man-made ecological marsh environment, multi-use fields, open meadow, and a patio garden (Greg Cantrell, Inc. 2006). Linear Park is an old road that is now used for biking and running. Bonnabel boat launch, parking lot, and fishing pier were repaired using FEMA funds in 2008 (Carr 2008). A fenced-in dog run and playground were also built at the boat launch. A 2.5-mile walking path parallels the east side of the West Return Floodwall levee in Jefferson Parish.

Active recreation on the east side of the levee occurs year-round (Carr 2008). There is a paved walking path on the east side of the levee (50 to 60 ft from the levee wall) and active and passive recreation occurs in the green space on the east side of the flood risk reduction features.

Zephyr Field is located on Airline Drive and is home to the Zephyr's AAA minor league baseball club. Zephyr Field seats 10,000 people, with additional seating for 1,000 on the levee in center field. The New Orleans Saints professional football team's training facility is also located on Airline Drive in Metairie and allows for some open practice visitation for the public during training.

The region of the proposed borrow sites located in the sub-basin is rich with recreational resources. However, specific borrow locations in the parish are on private lands, contain no recreational infrastructure, and are inaccessible to the public. Immediately adjacent to the West Bank I borrow site is Bridge City Playground (Jefferson Parish). There is a gymnasium for basketball and volleyball use, a baseball field, and a picnic shelter at the playground (Williams 2009b).

Orleans East Bank Sub-basin

New Orleans Recreation Department manages numerous playgrounds, complexes, parks, playspots, stadiums, and centers. Most are not within or adjacent to the project area. Coconut Beach, however, is located southwest of the west end levee between the 17th Street Canal and West Roadway Street. It has several heavily utilized sand volleyball courts known as Coconut Beach Volleyball Complex (CBVC). The volleyball complex offers a unique recreational

opportunity not otherwise available in the region. In July 2007, the complex hosted a regional qualifying event for the U.S. Open of Beach Volleyball. The CBVC leases its land from the City of New Orleans and pays taxes and revenue to the city, which are then used to maintain West End Park. A representative of CBVC stated that 316 teams play per week, attracting around 2,600 people to its 13 outdoor lighted courts. The CBVC relocated to Kenner near the Pontchartrain Center in spring 2012.

Lakeshore Drive is a major recreation destination centered in a park-like linear green space setting that follows the meandering lakefront seawall and is located for most of its length between the shoreline and the risk reduction system. Lakeshore Drive has some limited use as a commuter route to the University of New Orleans, but otherwise is a leisure/recreational boulevard. It is utilized quite extensively by cyclists and biking clubs in the region. The Orleans Levee Board closes two-way traffic on the street on weekends, so that traffic flows only eastbound from West End Boulevard to Bayou St. John. The westbound lanes are open for bicyclists and skaters, as well as to provide a buffer area for pedestrians near the seawall.

Fleur de Lis Park is located less than a quarter of a mile south of the LPV lakefront levee project area. There are baseball diamonds, basketball courts, a paved sports area, and playground equipment located at the site. Mickey Retif Playspot is located adjacent to the LPV Lakefront levee project area.

Orleans Parish lakefront area is rich with recreational resources in the vicinity of the HSDRRS projects, including boat ramps, multipurpose paths, shelters, picnic tables and benches, wildlife viewing areas, and fishing opportunities along the protected and flood sides of the flood reduction system. Lakeshore Park offers green space and a parking area with shelter (see figure 4-8). Furthermore, Orleans Marina provides a large parking area and boat ramps with access to Lake Pontchartrain.

City Park is one of the largest urban parks in the Nation and has state, National, and international visitors. While the land is owned by the city, it is administered by the DCRT, specifically by the City Park Improvement Association and its Board of Commissioners (DCRT 2010). The New Orleans Museum of Art resides at the park. Trees in the mature live oak grove are over 600 years old. The park provides opportunities such as birding, fishing, a botanical garden, a forest, an arboretum, an amusement park, and summer camps. Numerous recreational facilities in the 1,300-acre park provide facilities for people to boat, bike, ride horses, play sports (e.g., football, golf, softball, and tennis), and exercise dogs at a dog park. Friends of City Park and the New Orleans Botanical Garden Foundation are nonprofit entities that support the park.

The Audubon Nature Institute manages 10 museums and parks in New Orleans, including Audubon Park and the Audubon Zoo in Uptown, the Audubon Aquarium in the Central Business District and the Insectarium in the French Quarter. The Audubon Nature Institute is a nonprofit organization that manages these facilities. New Orleans is also home to numerous museums and galleries, both public and private. This includes the New Orleans Museum of Art located in City Park, the Ogden Museum of Southern Art, and the National World War II Museum, both located in the Warehouse District.

The Mercedes-Benz Superdome and New Orleans Arena are both located in the Central Business District of New Orleans. The Superdome is the home facility for the National Football League's New Orleans Saints, and eight regular season games are played at the facility annually. The Superdome also hosts the Sugar Bowl annually, the Bowl Championship Series National Championship game once every 4 years, and periodically hosts the Super Bowl. The New Orleans Arena is home to the National Basketball Association's New Orleans Hornets, and also hosts other major sporting events and music concerts.

New Orleans East Sub-basin

Lake Pontchartrain is an important recreational resource and provides boating and fishing opportunities for the Greater New Orleans Metropolitan Area. In the vicinity of the Seabrook gate complex, the Frank Davis Fishing Pier extends from the shore underneath the Seabrook Bridge and is managed by the Orleans Levee Board. This pier is regionally known for catches of white trout, speckled trout, flounder, redfish, sheepshead, black drum, and Atlantic croaker, primarily due to its proximity to the existing scour holes (Davis 2007). Fishing conditions in the area are also thought to be positively influenced by certain tidal flow patterns, specifically when water moves from the IHNC into Lake Pontchartrain (St. Charles Herald Guide 2008).

Although fishing occurs within all portions of the IHNC, and the Seabrook area is anecdotally reported to be the second best fishing site in the state, public access to the shores of the IHNC is officially restricted and fishing is not allowed. The Port of New Orleans Harbor Police Department has established a no-fishing zone for the entire IHNC, which includes restrictions on crabbing, fishing, and shrimping. Despite the posted warnings and the fact that Port of New Orleans Harbor Police Department officers have the authority to enforce these laws, fishing does occur along the IHNC.

South Shore Harbor, located adjacent to the Lakefront Airport, offers open and covered slips and is home to the South Shore Yacht Club. Levees along Lake Pontchartrain provide a trail system that is used by the public for walking, running, and bicycling (see figure 4-8).

Several parks administered by the City of New Orleans Recreation Department are located near the project area. The 187-acre Joe W. Brown Memorial Park, located about 1.5 miles south of the project area, was temporarily closed following Hurricane Katrina, but partially reopened in June 2007. The park includes an indoor swimming pool, a full-size soccer field, tennis courts, and several basketball courts. In addition, the entire park is undergoing \$20 million worth of improvements, which includes restoration of the heated swimming pool, renovations of ball fields, shelters, seating, landscaping and the fountains, so the full 187 acres of the park can be reopened. Also, a planned renovation for the park's multipurpose community center is in the design phase. Several smaller neighborhood parks, such as Kenilworth Park and Gorette Playground, are located just south of the project area.

The Six Flags New Orleans amusement park, formerly known as Jazzland, was closed in 2005 after being destroyed by Hurricane Katrina. The park is not scheduled to reopen as part of the Six Flags system, but several redevelopment concepts (see figure 4-8) have been proposed since 2006, including a redevelopment concept in 2009 by Nickelodeon, Baton Rouge-based Southern Star Amusement, and the New Orleans Mayor's Office.

Lincoln Beach is located along the south shore of Lake Pontchartrain. It operated from 1939 through 1965 until other beaches and amusement parks in the New Orleans area were desegregated. The facilities included rides, games, a swimming pool, beach front swimming, and a venue for live music performances. There is some discussion of reopening Lincoln Beach by three developers -- Atlanta-based Nolatown, Covina, California-based International Performance Packaging Company, and Monrovia, California-based Nardi Associates. The redevelopment effort construction is planned after the HSDRRS work is complete. The \$477 million project would include green space, an entertainment complex, gathering areas with cultural themes, recreation, commercial and hospitality areas, residential facilities and support areas, and a commuter train stop. The residential housing is planned to include 400 condominiums and a 500-vehicle parking garage (New Orleans City Business 2009).

Bayou Sauvage NWR was established in 1990. The refuge is one of the last remaining tracts of contiguous marsh located adjacent to Lake Pontchartrain and encompasses approximately 23,000 acres. The refuge contains a wide variety of habitat, including BLH, fresh and brackish water

marshes, lagoons, canals, borrow pits, cheniers, and natural bayous. Most of the refuge is located within levees built to reduce the risk of damage to New Orleans East from storm surges and flooding. A network of pumps and flap-gated structures regulate water levels seasonally to encourage summer growth of emergent plants that, in turn, provide waterfowl food supplies in winter (USFWS 2010).

Chalmette Loop Sub-basin

NPS administers sites in St. Bernard Parish include the Chalmette Battlefield, a park that is the site of the Battle of New Orleans, and a National Cemetery (figure 4-9). The Malus-Beauregard House serves as a museum and visitor center at the Battlefield. Additional recreational activities include a riverboat tour of the area, reenactments of the Battle of New Orleans during January of each year, and a walking trail and picnic tables.

State-administered areas in the parish include St. Bernard State Park (see figure 4-8) and the Biloxi Wildlife Management Area (WMA). The park provides diverse recreational opportunities in wetlands and woodland areas such as nature trails, wildlife viewing, swimming pools, picnic tables, and play areas. The Biloxi WMA is managed by LDWF and is accessible only by boat via commercial launches at Hopedale and Shell Beach. Fishing, hunting, boating, crabbing, shrimping, and bird-watching activities are all available at the Biloxi WMA. St. Bernard Parish Recreation Department serves several smaller parks in the area. Of all the recreation sites in the parish, St. Bernard State Park is the only site that is located in the vicinity of the HSDRRS actions.

The Contreras Dirt Cells, 1418/1420 Bayou Road and 1572 Bayou Road, and Dockville borrow sites are located in the sub-basin and do not have any recreational resources in the immediate vicinity of the project site. Similarly, most of the remaining borrow sites in the parish (e.g., 1025 Florissant Hwy, Acosta, and Johnson/Crovetto) have potential recreational value, but are located on private lands with no public access. The Spoil Area borrow site is in close proximity to Bashman Bayou, Terre Beau Bayou, and Bayou Dupre, three Louisiana-designated Natural and Scenic rivers. The bayous connect the MRGO and Lake Borgne; Lake Borgne provides access to the Gulf of Mexico, and recreational activities in these waters include fishing and boating.

Belle Chasse Sub-basin

Three recreational areas exist near the HSDRRS project corridor – the Bayou Barriere public golf course, a small parish park under the west approaches to the bridge on the west side of Algiers Canal (Belle Chasse Walking Park), and fishing and recreational boating in the GIWW, Algiers Canal, and Harvey Canal. Bayou Barriere, a 27-hole public golf course, is on the east side of the Algiers Canal north of the LA 23 Bridge in Plaquemines Parish (see figure 4-8). The golf course is located longitudinally along the existing levee system with several course holes that abut the levee. A new clubhouse was constructed recently, and several of the amenities at the site are currently under construction. Audubon Nature Institute is planning the Parc des Familles project in Crown Point. When the project is complete, the park would be the metro area's second-largest park. The JLNHPP is located adjacent to the Belle Chasse, Gretna-Algiers, and Harvey Westwego sub-basins. The JLNHPP provides a wide range of recreational opportunities for visitors that include bird watching, wildlife viewing, hunting, hiking, canoeing, biking, picnicking, and photography, as well as water-oriented sports like fishing, waterfowl hunting, and boating.

Gretna-Algiers Sub-basin

Located in Jefferson and Plaquemines parishes, Bayou Aux Carpes lies to the west of the Harvey and Algiers Canals and the GIWW (see figure 4-9). It was designated as a Section 404(c) wetlands area in 1985 (USEPA 1985 and *Federal Register* 44267-47268) and the final determination was amended in 1992 (USEPA 1992 and *Federal Register* 13745-13746).

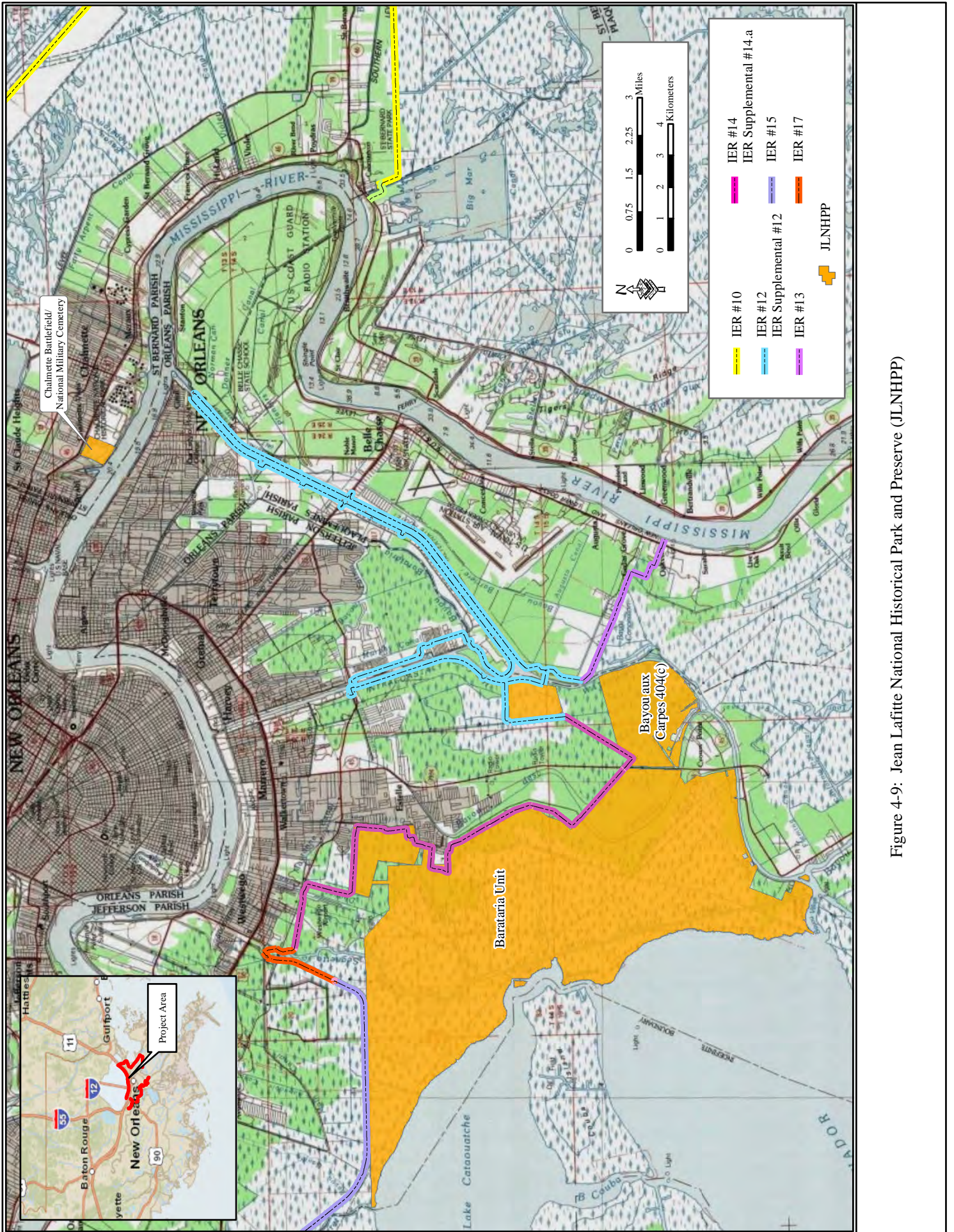


Figure 4-9: Jean Lafitte National Historical Park and Preserve (JLNHPP)

The Bayou aux Carpes CWA Section 404(c) swamp north of Crown Point was incorporated into the JLNHPP as part of the Omnibus Public Lands Management Act of 2009. A Recommended Determination was signed on August 16, 2010, modifying Bayou aux Carpes CWA Section 404(c) and allowing the USACE to propose flood control features within the area.

Harvey-Westwego Sub-basin

Marrero Park is located near the HSDRRS project area. The JLNHPP is also located adjacent to the Harvey Westwego sub-basin, and is discussed in the Belle Chasse and Gretna-Algiers sub-basins discussions above.

Lake Cataouatche Sub-basin

Bayou Segnette State Park is one of two state parks located in or near the HSDRRS project vicinity (see figure 4-8). A 580-acre park, it provides access to water-based recreation amenities such as boat launches, fishing piers, an outdoor swimming pool, and a wave pool (DCRT 2009a). Both saltwater and freshwater recreational fishing are available within and near the park. Canals and borrow pits contain fish and shellfish that are important to recreational fishing. Wetlands in the project area provide habitat for recreationally harvested red swamp crawfish. There are also picnic sites, playgrounds, wildlife viewing areas and, overnight facilities at the park. Overnight facilities include campsites, waterfront cabins, a group camp site with dormitories, and a meeting room. Bayou Segnette provides boat access from the West Bank to Lake Cataouatche and Lake Salvador, and the Barataria Basin (see figure 4-8). Lake Salvador and JLNHPP are south of the project area.

Potential Recreational Resources outside the HSDRRS Sub-basins

Recreational resources adjacent to the HSDRRS actions outside the sub-basins (i.e., borrow sites) are discussed in this section of the CED.

No recreational resources exist at borrow sites (Bocage, Raceland Raw Sugar, St. Gabriel Redevelopment, Big Shake, Willow Bend and Willow Bend Phase II, and Tammany Holding) in the Louisiana parishes. Furthermore, no recreational resources exist at or adjacent to the Henley borrow site in Mississippi.

East Baton Rouge Parish

The Lilly Bayou borrow site in the parish is privately owned, and hunting leases exist on the site. Additional recreational uses of the adjacent Mississippi River and backwater areas include fishing, crawfishing, and boating.

St. Charles Parish

There are no National parks or preserves located in St. Charles Parish. Two scenic streams are located in St. Charles Parish (Bayou Trepagnier and Bayou LaBranche); however, they are not located in close proximity to the HSDRRS. The brackish marsh LaBranche Wetlands is located within the HSDRRS. It provides important aquatic habitat and ecosystem functions, as well as recreational opportunities in the area. The 7,600-acre Bonnet Carré Spillway is located in St. Charles Parish, west of the project area. Bonnet Carré Spillway is a flood control structure in the Lower Mississippi Valley administered by the USACE.

Local residents use the Bonnet Carré Spillway for recreation and, in recent decades, use of the area has become more regulated and organized (USACE 2008e). Bonnet Carré Spillway offers several outdoor recreation opportunities, including boating, water skiing, fishing, crawfishing, swimming, hunting, birding, dog training, and areas for operating off-road motorcycles, all-terrain vehicles (ATV), and radio-controlled airplanes (USACE 2008e). The CEMVN has

prepared a Master Plan for the Bonnet Carré Spillway, which discusses these many recreational activities (USACE 2010f); however, the Master Plan is not yet final.

Several recreation outgrants and leases have been issued to state and local agencies for use within the Bonnet Carré Spillway. St. Charles Parish outgrants the US 61 Lower Guide Levee Recreation Area (US 61 Recreation Area; see figure 4-8), which is heavily utilized and is officially designated as a recreational area, located very near the St. Charles sub-basin. Some features of the US 61 Recreation Area include a two-lane concrete boat launch, paved parking, fishing docks, a metal shed pavilion, picnic tables, and primitive camping sites. The USACE is considering a plan to build a wetlands watch area in the US 61 Recreation Area.

The USACE issues numerous permits for recreational activities on a case-by-case basis. The USACE has issued annual use permits to the Spillway Radio Control Club since 1972 for radio-controlled model airplanes at a designated site near the spillway. New permits/outgrants include the South Louisiana Trailblazers, the ATV club, and New Orleans Metro Area Mountain Bike Organization. The New Orleans Metro Area Mountain Bike Organization maintains a 5.5-mile mountain bike trail and the two other organizations maintain off-road ATV trails (New Orleans Metro Area Mountain Bike Organization 2009).

St. Charles Parish Recreation and Parks Department has numerous parks, ball fields, and gyms. Two private boat ramps exist on the flood side of the existing levee in St. Charles Parish. One of the boat ramps is more substantial and heavily used than the other.

The 3C Riverside borrow site is privately owned and not open to the public. The site has limited recreation potential, but offers potential hunting opportunities.

Jefferson Parish

JLNHPP is located adjacent to the HSDRRS in Jefferson Parish (see figure 4-9). The 28,600-acre park and preserve is managed by the NPS and consists of several units, including the Barataria Preserve, which contains approximately 21,000 acres and now includes the Bayou Aux Carpes CWA Section 404(c) area. There are four management zones in the core of the JLNHPP: the natural zone, the cultural resource zone, the park development zone, and the other-use zone. The natural zone was designated to help preserve the core area's natural values (USACE 2008g). A day-use parking area, canoe launching areas, and hiking trails are within the park development zone. Free programs and events are also held in the park development zone.

JLNHPP is open year-round and offers several outdoor activities in its Barataria Preserve.

Several Barataria Preserve buildings were affected during the 2005 storms, but reopened in October 2005 (NPS 2010). The JLNHPP provides a wide range of recreational opportunities for JLNHPP visitors. The Barataria Preserve Unit includes a visitor center, day-use parking areas, and canoe and hiking trails. Typical visitor activities include bird watching, wildlife viewing, hunting, hiking, canoeing, biking, picnicking, and photography. Water-oriented sports including fishing, waterfowl hunting, and boating occur in areas of the park with water access. The preserve also has active squirrel, nutria, rabbit, deer, and waterfowl hunting programs (USACE 2008g).

In March 2009 Congress passed the OPLMA, Public Law 111-11, which transferred the administration of the "CIT Tract" from the USACE to the NPS for inclusion into the JLNHPP Barataria Unit. The CIT Tract was acquired by the U.S. in 1994 in settlement of a regulatory taking suit brought against the U.S. stemming from a Section 404 permit denial by the USACE, the CIT Group/ Equipment Financing, Inc. v. United States, Claims Court No. 90-4027L. The OPLMA also requires that those two agencies determine what portions of the CIT Tract would

be needed “to ensure adequate hurricane protection of the communities located in the area” (16 U.S.C. 230a section (a)(1)(B)(iii)). The CEMVN and the NPS are in the process of working out that plan. Currently the plan is for the NPS to exchange property, through the CEMVN, with the West Jefferson Levee District, whereby the West Jefferson Levee District would own the land needed for the WBV project, and the NPS would own other property more suitable to inclusion in the JLNHPP. The appraisal, titles, and other transfer matters are currently under way in order to achieve this end.

The project area for a segment of the HSDRRS includes the northern border of the Davis Pond Freshwater Diversion Project. Several regionally important recreation areas exist south of the project area, including Lake Cataouatche, Lake Salvador, and the Barataria Bay (see figure 4-8). Fishing and hunting are popular recreation activities in the Barataria Basin. A public boat ramp allows easy access to Lake Cataouatche and Lake Salvador, Salvador WMA, Salvador/Timken WMA, and Barataria Preserve; these water bodies are only accessible via boat. Salvador and Timken WMAs are also important wildlife areas influenced by the Davis Pond Diversion Project.

St. Bernard Parish

Local parks and golf courses in the parish include two golf courses at Alvin Callendar Field (see figure 4-8). Borrow pits within the parish are not open to the public (e.g., 4001 Florissant, 1025 Florissant St., Acosta, and Acosta 2) and offer no recreational value. There is no recreational use of the Acosta 2 borrow site or adjacent lands (which includes the Acosta [1] borrow site).

Plaquemines Parish

There are no Federal parks or preserves in Plaquemines Parish, but there are several local parks. Parish parks were substantially damaged during Hurricanes Katrina and Rita; however, Project Rebuild Plaquemines helped repair three parks, and construction of a park in Port Sulphur was completed in early 2010 (Campbell 2010). Project Rebuild Plaquemines helped build or rebuild baseball diamonds, bathroom facilities, walking tracks, picnic tables and benches, and BBQ pits, installed high-quality playground equipment, and installed a “new” feature at each site (Table 4-21). Braithwaite Community Park features green space, ball field, picnic areas, and an old 18-hole golf course that could be revitalized (see figure 4-8). Cypress Park in Belle Chasse was completed in May 2010. Upon completion of the construction, Plaquemines Parish Government Recreation (PPGR) will manage eight parks throughout the parish, but none of them are adjacent to HSDRRS borrow projects (PPGR 2009).

Table 4-21. Plaquemines Parish Parks Features Added since Hurricane Katrina

Park	Location	New Feature
Leroy Harvey Park	Boothville-Venice	Skate park
Roger Halpen Park	Buras	Water park
Percy Griffin Memorial Park	Davant	Amphitheatre
Port Sulphur Park	Port Sulphur	Basketball
Cypress Park	Belle Chasse	Beach volleyball

4.2.10.2 Impacts of HSDRRS

4.2.10.2.1 HSDRRS 2011 Impacts

Construction of the flood risk reduction features and the excavation of borrow pits adversely impacted recreation in the project area; however, these impacts were short-term impacts. Access to land- and marine-based recreational opportunities and resources were affected. Recreational

resources were affected through the alteration of the physical site and noise and vibration impacts. Green space and paved biking/jogging/running paths were temporarily or permanently inaccessible to recreationists. Several recreational facilities and associated infrastructure were rendered unusable during construction. Many proposed borrow sites located throughout the HSDRRS project area offer little recreational value; therefore, the excavation of the borrow pits had negligible permanent impacts on recreational resources in the project area.

Construction of the HSDRRS also caused beneficial impacts on recreational resources through reduced risk of flood and storm damage to recreation facilities, infrastructure, and parks in the vicinity. Furthermore, access to some facilities was improved following completion of HSDRRS construction as new ramps, steps, and access roads have been constructed. Additionally, compensatory mitigation projects that potentially may be constructed in state or Federal wildlife areas would allow the public an added benefit of access to and recreational use of these areas (i.e., hiking, fishing, wildlife viewing), thereby providing beneficial impacts on recreational resources.

General construction BMPs would also minimize impacts on recreational resources. The mitigation measures implemented by the USACE are discussed in section 5.0.

St. Charles Sub-basin

Raising levees, replacement of floodwalls, and the modification and closure of drainage structures and railroad gates affected recreational fishing because of increased water turbidity and sedimentation. Impacts were temporary in nature, and recreational opportunities in the sub-basin were expected to return to pre-construction conditions.

Jefferson East Bank Sub-basin

Minor permanent impacts occurred on recreational resources. The replacement of floodwalls on a new alignment temporarily impacted fishing opportunities, and dredging in Lake Pontchartrain temporarily suspended recreational activities at and near the HSDRRS. Further, the walking path/bike trail and green space were not likely available for use during construction, and the paved path had the potential to be damaged if material transport occurred on the protected side of the levee. In the long term, local government could repair any damage to the walking path following the completion of construction activities. Bank fishing in the Jefferson East Bank sub-basin was temporarily affected during construction. Indirect impacts from dredging potentially caused increased turbidity in nearby wetlands and Lake Pontchartrain, but these impacts were reduced through BMPs. Benefits for recreational resources included the construction of a larger green space on the east side of the levee.

Temporary direct impacts occurred on recreational features associated with biking/walking/jogging, wildlife viewing activities, and boating and fishing. Staging or stockpiling areas were required along the Pontchartrain Lakefront, in addition to the potential staging areas at nearby boat ramps and launches, which had minor, temporary impacts on recreation in the area. Access to multi-use paths in the sub-basin were temporarily suspended during construction activities, and parts of the paved path had the potential to be permanently damaged during construction. However, the local sponsor could repair the paths following construction activities. The protected side of the new 4 ft high I-wall is paved and has slope paving that could be used as a walking /biking path. However, walking/biking path users cannot cross to the flood side of the I-wall, as there is a 4 ft drop-off and the USACE plans to construct a 2 ft safety fence on top of the I-wall.

Indirect temporary impacts on recreational fishing and boaters occurred during construction due to water turbidity, and stockpiled soil potentially posed a shallow water hazard to boaters near construction sites; in some IERs it was noted that hazards from stockpiled soil were mitigated with the use of buoys demarcating the location of material (IER #3). Additionally, risk reduction

from storm surge damage and additional lake fishing was realized through the construction of the HSDRRS flood risk reduction projects.

Orleans East Bank Sub-basin

Replacement of floodwalls had short-term impacts on parking and access to recreational resources in the Orleans East Bank sub-basin. Access to some recreational resources on Lake Pontchartrain was prohibited during the HSDRRS construction, with some areas unavailable for months and users inconvenienced due to the uncertainty of closure duration. Lakeshore Drive is used as a meeting place for club activities such as bicycle and car clubs and by other active and passive recreational users. Parts of Lakeshore Drive were closed for months, and bike clubs, cyclists, and other recreationalists were not able to use sections of this recreation corridor during construction activities. Cyclists could use parts of the drive, but were forced to detour into nearby neighborhoods due to road and bridge closures. Alternate routes for bicyclists and vehicles included Robert E. Lee and Leon C. Simon boulevards. Old Pontchartrain Beach, which is a very popular local swimming area located near the University of New Orleans, was unavailable for many months due to construction activities related to the levee improvement. Access to the Lakeshore Park multipurpose path was temporarily impacted during construction but was not rendered inaccessible. Parking areas at recreation points in the project vicinity were temporarily impacted during construction for staging areas and construction easements. Construction easements also limited access to and the use of fishing piers and boat ramps in the project vicinity during construction. Recreational access was affected from staging areas, construction easements, and temporary road closures in the sub-basin. Lack of access to recreational resources within the vicinity of the HSDRRS potentially caused additional demand on other recreational resources in the sub-basin. Increased turbidity in waters near the project area was minimized through the use of BMPs but temporarily impacted recreational fishing opportunities in the area.

Minor permanent impacts occurred on recreational resources. Future construction of three new permanent pump stations in this sub-basin would remove park land and publicly owned green space, and thereby some recreational resources in the area would be impacted. The CBVC, located near West End Park, offers a unique and very popular recreation opportunity in the region. The heavily utilized sand volleyball courts are closed and will be moved elsewhere in the project area because of the permanent pump station construction. However, there are other recreational and green space areas within the project area.

Publicly owned green space and jogging and walking pathways were acquired for the HSDRRS in the Orleans East Bank sub-basin, thereby permanently removing existing and potential recreational opportunities in the area.

New Orleans East Sub-basin

Realignment and construction of levees, floodwalls, and floodgates in the sub-basin caused short-term impacts on recreational resources. Increased noise in the project vicinity caused short-term impacts on nearby recreational facilities, such as playgrounds and parks, and on activities such as hunting, bird watching, and fishing at Bayou Sauvage NWR. An existing bike trail was utilized for construction activities and was not available for recreation until construction was complete, damage to the bike trail was repaired. Temporary road closures near some floodgates and boat ramps (boat launch) required boaters and fishermen to detour several miles during construction activities, but access was still granted.

Minor permanent impacts occurred on recreational resources. Pedestrian access to Lake Pontchartrain was permanently hindered along one reach of the HSDRRS. Intermittent concrete steps that provided pedestrian access up to the levee crown and down to Lake Pontchartrain were removed. Following removal, the levee crown was still accessible; however, no passage to Lake

Pontchartrain was provided due to a new floodwall on the levee, thereby permanently affecting recreational fishing in the vicinity of the HSDRRS.

Construction of the Borgne barrier and Seabrook gate complex had a temporary effect on recreational fishing (via both bank and pier access) in the New Orleans East sub-basin area and adjacent waterways. Fishing opportunities in the marsh on the protected side of the barriers was also temporarily adversely affected due to a more limited influx of fish and saline water. Boat ramps and bank and pier fishing areas were temporarily impacted, due to the construction of the Seabrook gate complex located at the mouth of the IHNC.

Construction of the Borgne barrier caused a temporary effect on recreational boating along Bayou Bienvenue and caused temporary impacts from construction noise. During construction activities, alternative routes were required for access to Lake Borgne and Bayou Bienvenue. After completion of the HSDRRS Borgne barrier, most recreational boats could access the lake via Bayou Bienvenue and a vertical lift gate, with taller vessels required to traverse the GIWW.

Construction of the Seabrook gate complex, which prevents storm surge from Lake Pontchartrain from entering the IHNC, had temporary construction-related impacts on fish habitats and navigation, thereby reducing recreational opportunities. During construction of the Seabrook gate complex, the cofferdam reduced access to the popular fishing location at the scour hole, thereby limiting local fishing opportunities. In addition, noise and vibration generated by construction activities had the potential to temporarily affect the quality of fishing at the intersection of the IHNC and Lake Pontchartrain. As part of the construction of the Seabrook gate complex, the scour hole was permanently filled. Recreational fishing at the scour hole was permanently impacted by the filling of the scour hole and due to changes in the velocities of currents. However, recreational fishing opportunities remain along the majority of the Lakeshore Park shoreline.

Vehicle access to the Seabrook Launch and Lakeshore Park boat access to Lake Pontchartrain were affected by HSDRRS construction activities. With construction complete, vehicle access to the Seabrook Launch was again available. Also, boaters had no direct access to the IHNC from Lake Pontchartrain during construction. However, alternate routes to the IHNC were available. Passive recreational activities at nearby Lakeshore Park were temporarily affected by vibration and noise impacts associated with construction. Passive recreationists at Pontchartrain Park were affected in the short-term by construction-related noise and vibration, but were buffered from the construction by an existing concrete floodwall.

Although there is currently no public access to borrow sites within the sub-basin, recreational resources at the excavated sites potentially improved. Within 2 years following excavation, the habitat at these borrow sites had the potential for being suitable for recreational activities such as bird watching, other wildlife viewing, and fishing. The ultimate reuse of these sites would be up to the landowner and not the USACE. A portion of Eastover Phase II borrow site was potentially restored for the golf course, and if the landowner chose, the pit potentially became a lake, possibly supporting a viable fishing option.

Chalmette Loop Sub-basin

Construction of a new flood control structure and sector gate, including the use of cofferdams, and construction of new levee and floodwalls, resulted in temporary disruption of access to hunting and fishing areas and organism movement in the vicinity of construction activities within the Chalmette Loop sub-basin. Fishery resources were removed with the installation of the structures, and had short-term effects on organism development, thereby having a temporary impact on recreational fishing. Access to private and public boat launches in the area was temporarily impacted during construction, but access to the boat ramps returned to normal upon construction completion. Temporary minor impacts on bird watching, wildlife viewing, and

recreational fishing occurred near the ROW during construction of floodwalls (T-walls) on the Chalmette Loop levee.

The privately owned borrow pits in the sub-basin are not open to the public; therefore, there were no impacts on recreation associated with the excavation of these borrow sites. The Spoil Area borrow site is mostly forested with BLH forest and wetlands and is intersected by Bayou Dupre and is currently vacant. Nearby camps potentially experienced short-term minor impacts from dust and noise during construction. The impacts were minimized with BMPs utilized at the project area and the camps. Project construction also had temporary, indirect minor impacts on hunting in the vicinity of the project area. As of July 2011, the Contreras borrow site was the only borrow site in this sub-basin utilized for the HSDRRS construction. No permanent impacts on recreational resources occurred.

Belle Chasse Sub-basin

The Belle Chasse Walking Park was closed during construction for approximately 6 months. During this time, minor impacts occurred on recreational opportunities. However, a nearby walking trail at Medal of Honor Park was open for walkers and alleviated some of the impacts from park closure during construction. No permanent impacts on recreational resources occurred.

Gretna-Algiers Sub-basin

Sediments that potentially escaped from erosion and sediment control features affected nearby water quality in the project area. Recreational activities in the Bayou aux Carpes CWA Section 404(c), now incorporated into the JLNHPP, were not adversely affected following the construction of the HSDRRS floodwall. Increased recreational activities were possible as a result of the implementation of the HSDRRS. No permanent impacts on recreational resources occurred.

Harvey-Westwego Sub-basin

Construction of an earthen levee with fronting protection, floodwalls, a sluice gate structure, and ancillary drainage structures had temporary impacts on recreational activities in the Harvey-Westwego sub-basin project vicinity, including traffic congestion and noise. Traffic congestion during construction impacted recreational access, and noise affected the general recreational experience.

Approximately 15 of the 42 acres of cypress-tupelo swamp filled by construction activities within the Harvey-Westwego sub-basin are part of the JLNHPP and offer recreational value. Filling these 15 acres resulted in minor permanent impacts on recreation, as the areas were no longer available for recreational purposes. Noise from construction activities also impacted recreational use within the JLNHPP. In particular, some minor temporary impacts associated with the demolition of the existing floodwall and construction of the new floodwall impacted recreational opportunities such as bird watching and wildlife viewing within the JLNHPP in the vicinity of the HSDRRS.

Lake Cataouatche Sub-basin

Minor permanent impacts on recreational resources occurred. Limited access to private and public boat ramps caused short-term indirect impacts on recreational resources in the project vicinity. Temporary and permanent bridges erected during HSDRRS construction potentially hindered boaters from accessing Davis Pond, Lake Cataouatche, and Salvadore and Timken WMAs. Access to Bayou Segnette nature trail was temporarily impacted during construction at the park. However, pedestrian and vehicular access gates were constructed through the floodwall, thereby supporting recreational access to amenities within the park.

The temporary and permanent bridges spanning the Outer Cataouatche Canal potentially impeded recreationists that attempted boat access to Davis Pond, Lake Cataouatche, or Salvador and Timken WMAs during the HSDRRS construction. Minor direct impacts on recreation occurred within the sub-basin through the loss or modification of open water habitat. Specifically, short-term direct impacts on water quality in the Outer Cataouatche Canal resulted from the placement of fill into the canal, from bank stabilization activities, from closure and bridge construction, and from construction and installation of a scour pad at the outfall of the new US 90 pump station.

Privately owned borrow pits in the sub-basin are not open to the public; therefore, there were no impacts on recreation affiliated with the excavation. One playground is adjacent to the Westbank I borrow site, Bridge City Playground, but it was not impacted. Potential short-term, minor impacts on recreation resulted from dust at the Avondale Community Center (located 1.0 mile from the River Birch Landfill Expansion borrow site) during excavation. However, that possibility was low given the distance and other structures located between the two sites.

contractor-furnished borrow pits and access routes in the sub-basin provide no recreational resources. Nearby features such as a golf course and neighborhood parks are at least 0.5 mile from the sites and access routes and would not be impacted by the HSDRRS action. As of July 2011, only Churchill Farms Pit A, South Kenner Road, Willswood, and the River Birch Phase 2 and River Birch Landfill Expansion, located in the Lake Cataouatche sub-basin, were utilized for the HSDRRS construction.

Impacts from Borrow Sites Outside of the HSDRRS Sub-basins

Most of the borrow sites located outside the HSDRRS sub-basin boundaries are privately owned and offer no recreational opportunities. However, table 4-22 outlines the work impacts at borrow sites that had pre-construction recreational value. Beneficial fish habitat could be created at any one of the borrow sites over time, should the landowners stock the new ponds and/or lakes with native fish species (see Fisheries section 4.2.5 for details).

Table 4-22. Borrow Sites with Recreational Resources Located Outside the HSDRRS Project Area

Parish/County	Borrow Site	Impacts from Borrow Activities
East Baton Rouge	Lilly Bayou	<ul style="list-style-type: none"> • Temporary minor impacts on hunting opportunities occurred during borrow pit excavation. • Persons with hunting leases were potentially displaced during borrow activities and recreationists using the project site to access the Mississippi River for bank fishing and crawfishing were temporarily impacted during material hauling. Other suitable land to hunt and fish were available; therefore, impacts on those recreational activities were minimal and insignificant. • The Lilly Bayou site was utilized by the HSDRRS construction.
Plaquemines Parish	Citrus Lands Conoco-Philips Idlewild Stage 1 Nairn Plaquemines Dirt and Clay	<ul style="list-style-type: none"> • Temporary minor impacts on hunting opportunities occurred during borrow pit excavation. • Nearby features, approximately 1 mile from the site, would not be temporarily impacted by the HSDRRS borrow actions. • Idlewild Stage 1 and Plaquemines Dirt and Clay borrow sites were utilized by the HSDRRS construction.

Table 4-22, continued

Parish/County	Borrow Site	Impacts from Borrow Activities
St. Charles	Bonnet Carré North	<ul style="list-style-type: none"> Excavation of material in the Bonnet Carré North area resulted in a temporary disruption of recreational activities in the region, but ultimately created new aquatic habitats that supported boating and fishing in the region. Areas used for ATV use and remote airplane recreation were impacted by the excavation but were relocated to other areas following excavation. Bonnet Carré North borrow site was utilized by the HSDRRS construction.
St. Tammany	Levis	<ul style="list-style-type: none"> Short-term, minor impacts on nearby athletic complex recreationists could occur from potential fugitive dust emissions and noise impacts during construction near the Levis borrow site. As of July 2011, the Levis site was not utilized by the HSDRRS construction.
Hancock	Henley	<ul style="list-style-type: none"> Potential recreational opportunities (hunting) would be removed if the King Mine borrow site were excavated. As of July 2011, the King Mine site was not utilized by the HSDRRS construction.

4.2.10.2.2 HSDRRS 2057 Impacts

Adverse impacts on recreational resources from future levee lifts would be negligible and would be limited to short-term recreational access closures during the actual construction activities. No permanent adverse impacts on recreational resources are anticipated from future HSDRRS work. Future borrow requirements (7.3 million cy) for levee lifts would require potential borrow sites to be investigated and have the environmental clearance required by the NEPA; therefore, the future borrow sites would be analyzed for any impacts on recreational resources.

4.2.10.3 Cumulative Impacts

4.2.10.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Temporary cumulative adverse impacts on recreational resources have occurred the project area; and temporary impacts primarily associated with access closures would occur for the life of the HSDRRS. Access and navigation to land- and marine-based recreational opportunities and resources have been affected. Noise and water quality issues from construction and future levee lifts cumulatively reduce fishing and hunting opportunities within the project area. In addition, the displacement of wildlife due to construction impacts would limit outdoor nature activities such as bird watching, hiking, and photography.

The HSDRRS would have long-term cumulative impacts on recreational fishing. In certain areas, such as the Seabrook gate complex and the protected side of the Borgne barrier (IER # 11 Tier 2 Pontchartrain and IER #11 Tier 2 Borgne), recreational fishing could take years to recover.

Recreational resources were affected through the alteration of the physical site and noise and vibration impacts from the HSDRRS. Green space and paved recreational paths were temporarily or permanently inaccessible to recreationists during construction. Some recreational facilities and associated infrastructure were inaccessible or unusable during construction. Generally speaking, the borrow sites located throughout the HSDRRS project area offered little

recreational value; therefore, the excavation of the borrow pits had negligible permanent impacts on recreational resources in the project area.

However, construction of the HSDRRS provides cumulative benefits for recreational resources in the area. The HSDRRS reduces flood and storm damage risk to recreation facilities, museums, sporting arenas, recreational paths, park infrastructure, and green space. Cumulatively, HSDRRS construction and borrow site excavation would have negligible permanent impacts on recreational resources.

4.2.10.3.2 Cumulative Impacts of Present and Future Regional Actions

Present and future actions by the USACE and other agencies, businesses, or the public would likely contribute to cumulative improvement to recreational resources, as many projects in the area include ecosystem and recreational infrastructure improvement.

Storm Damage Reconstruction

In conjunction with ongoing efforts to restore existing floodwalls, floodgates, and levees throughout the area, there are ongoing government- and community-based efforts to restore and create new recreational opportunities in the HSDRRS project area. Although some of the reconstruction projects would temporarily reduce the access to existing recreational opportunities, in the long term, both quantity and quality of facilities and related infrastructure and managed lands would improve, contributing to an overall beneficial cumulative impact on recreational resources in the area. Community groups such as the Holy Cross Neighborhood Association of the Lower Ninth Ward and the Sierra Club New Orleans group have invested money and personnel into improving and increasing recreational opportunities in the project area.

Rebuilding schools in the hurricane-affected areas would have a positive effect on recreational resources and green space in the region. Restored and newly created ball fields, playgrounds, and soccer fields would provide recreational opportunity and recreational infrastructure for individuals living nearby. Major and minor renovations on municipal buildings, parks, community centers, and street repair projects in Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany parishes would improve recreational resources.

Community revitalization has been a central focus in rebuilding areas affected by Hurricane Katrina. The New Orleans Food and Farm Network (a grant funded through Greater New Orleans Foundation) would implement urban vegetable gardens through community outreach, garden site planning/development, and horticultural training. Urban vegetable gardens would provide green space throughout the city and foster opportunities for community involvement (New Orleans Institute 2010). Parkway Partners is a nonprofit organization involved in the planning and construction of community centers and replanting of trees across the city. Since Hurricane Katrina, Parkway Partners has initiated ReLeaf New Orleans – a process to plant trees in 32 neighborhoods. Opportunities such as these provide green space in the city, but also a place where the community can come together (Parkway Partners 2010).

Redevelopment

Community redevelopment includes improvements to parks, playgrounds, walkways, and bikeways throughout the Metropolitan New Orleans area. Numerous examples of these projects are listed below and are creating recreational opportunities. Project Rebuild Plaquemines is part of the redevelopment effort in the parish and was started following Hurricane Katrina in 2005. Project Rebuild helped rebuild three parks and construct one new park in Port Sulphur (Campbell 2010), as discussed earlier in the affected environment portion of this section. There would be no impact on these parks with the modifications and new construction related to the HSDRRS system.

Other redevelopment projects affecting recreational resources in the project area include:

- Bonnet Carré Spillway - New facilities/actions proposed for development include the establishment of a four-wheel-drive truck area, establishment of a horseback riding area, providing for a safe channel into Lake Pontchartrain, and inclusion of a bicycle trail along St. Charles Parish Road 12 (SC-12 or Spillway Road, USACE 2010f).
- City of New Orleans has plans to rebuild or newly construct various parks, pools, playgrounds, and other facilities (City of New Orleans 2010a).
- St. Charles Parish is preparing a Comprehensive Land Use Plan that will create policy goals for every aspect of the community, including, for example, land use, transportation, housing, parks and open space, infrastructure, and economic development (St. Charles Parish Government 2010b).
- Trail projects in the vicinity and throughout Louisiana are implemented annually with FWSA Recreational Trails Program grant funds. For the application year beginning May 2010, \$1,436,043 was available, with 80/20 percent matching for trails projects (Louisiana Office of State Parks, Division of Outdoor Recreation 2010). These projects would include the creation of trails for motorized and non-motorized use, and funding for related needs.

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects, including the restoration or creation of marshes, would increase the quality and quantity of recreational resources in the project area. Ecotourism would increase in areas such as the LaBranche Wetlands and the Harvey-Westwego area. Individuals gaining access to the marsh would allow for increased ecotourism, and seafood would also draw tourists.

Several proposed wetlands restoration projects in the project area would potentially improve water quality in several nearby water bodies, including Lake Pontchartrain, Lake Salvador (shoreline protection), MRGO, and Lake Borgne. Marsh restoration projects, such as Management of Rosethorne Municipal Effluent project and the South Shore of the Pen Shoreline Protection and Marsh Restoration project in Jefferson Parish, would also improve aquatic habitat and potentially provide habitat for fish displaced from turbidity or other construction-related impacts. Operation of the CFDC, in conjunction with other marsh and wetlands restoration projects, would reduce the potential adverse impacts of the HSDRRS by providing additional recreational fishing opportunities.

Projects proposed, such as the Coastal Restoration Forest Initiative, would restore, protect, and conserve ecologically valuable lands in Louisiana's coastal forest system. Implementation of these types of projects would provide for new and improved recreational experiences in forested ecosystems.

One such example of a coastal and wetlands restoration project directly affecting recreational resources in the region would include the Wetlands Watchers Park. Opened in October 2010, the park is maintained by St. Charles Parish Recreation Department (St. Charles Parish Government 2010a). The 28-acre area was created for education, recreation, and restoration. School children and other interested parties will potentially visit the outdoor classroom and the park to learn about Louisiana's diverse and valuable coastal ecosystems.

Flood Risk Reduction Projects

In conjunction with the HSDRRS, levee modification along the Mississippi River and MRGO deep-draft deauthorization would temporarily impact recreational resources in the New Orleans

area. Coupled with the loss of recreational areas such as parks, ball fields, and other recreational areas from Hurricane Katrina, this would contribute to additional cumulative adverse impacts on recreational resources in the area.

The NOV flood risk reduction project is currently in the planning process, but would affect thousands of acres of wetlands. These wetlands would be replaced with infrastructure such as levees, floodwalls, etc. Construction activities and noise would temporarily affect the recreational experience in a manner similar to the HSDRRS. Although opportunities for recreational boating, fishing, and wildlife viewing would be permanently affected, the quality of other recreational sites in the area would improve with the increased risk reduction from the project.

Pump stations and other flood risk reduction infrastructure being built as part of the SELA project, which is ongoing across New Orleans, would not likely affect recreational resources because they would be rebuilt in areas currently used for flood risk reduction. New canals constructed as part of SELA project would contribute to the decline in recreational resources if wetlands habitats or aquatic habitats are destroyed and replaced with infrastructure or drainage canals.

Transportation

Bridge widening and street repair could temporarily displace recreationists or limit access to recreational spots, but following construction, recreational opportunities should return to pre-construction conditions. The extension of I-49 would temporarily impact wetlands and other aquatic habitats used for fishing and crabbing at highway crossings, but the impacted areas would be returned to pre-project conditions following construction. The IHNC Lock Replacement Project would limit some access across and along the IHNC for the 12-year construction project period. The I-12 to Bush, Louisiana project would clear undeveloped land to construct new sections of roadway, resulting in the loss or degradation of habitat used for nature-based recreation.

Other transportation-related projects in the HSDRRS project vicinity (e.g., Twin Spans Bridge, Causeway/I-10 Interchange) could temporarily affect recreational resources if green spaces are used for staging areas, the public is prohibited from accessing recreation areas due to road closures, or traffic delays prevent the possibility of recreation use.

4.2.10.3.3 Summary of All Cumulative Impacts for Recreational Resources

Recreational resources would experience temporary cumulative adverse impacts due to the HSDRRS and other ongoing and future regional projects during construction activities. Where construction projects cross recreational areas, temporary closures of access can occur. Some green space and other recreational areas may be permanently lost or impacted, but cumulatively, improvements offered through these regional projects would provide beneficial effects on recreational resources in the HSDRRS area. Regionally, the permanent cumulative impacts on recreational resources would be negligible.

4.2.11 Aesthetics

4.2.11.1 Affected Environment

This resource's institutional significance is derived from laws and policies that affect visual resources, most notably the NEPA, the Coastal Barrier Resources Act of 1990, and the National and Local Scenic Byway Programs. Aesthetic resources are technically significant because visual accessibility to unique combinations of geological, botanical, and cultural features is an asset to a study area. Public significance is based on expressed public perceptions and professional evaluation.

Much of the HSDRRS corridor is currently comprised of levees, floodwalls, and floodgates that reduce the visual appeal and interrupt the line of sight between the urban environment on the protected side and the natural environment on the flood side as shown in the photograph 4-4. Levees that compose a portion of HSDRRS do provide opportunities to view wetlands and estuarine environments on the protected side of levees and offer some of the most important aesthetics in the region. Lakes Pontchartrain, Borgne, and Cataouatche and surrounding wetlands are visible from the HSDRRS structures, and the HSDRRS in New Orleans East and St. Bernard Parish bisects wetlands and open water bodies of Bayou Sauvage NWR and the Central Wetlands Unit, respectively. The levee components of these reaches provide an excellent line of sight into these large wetland complexes.



Photograph 4-4. Examples of floodwalls and levees with floodwall caps.

Much of the protected side of the Jefferson and Orleans East Bank HSDRRS corridor is composed of residential and commercial development. The protected side of the St. Bernard and Jefferson West Bank HSDRRS corridors also contains a substantial amount of residential and commercial development. However, industrial development, primarily associated with the maritime industry, is common along segments of the HSDRRS. Vacant lots and city parks are also sporadically located along all reaches of the HSDRRS.

St. Charles Sub-basin

Within the St. Charles sub-basin, the visual landscape of HSDRRS is dominated by earthen levees, unimproved access roads, drainage canals, and borrow areas. In addition, structures and facilities related to the petroleum industry, such as storage tanks and piping, are also prevalent. To the north of the project area, the natural setting of the St. Charles sub-basin is dominated by swamp. Within this area are Bayou Trepagnier and Bayou LaBranche, which are part of the Louisiana Natural and Scenic River system. Both bayou corridors are largely undeveloped and provide open vistas of solid and broken marshes interspersed with natural levees and spoil banks that support woody vegetation. To the northwest of the St. Charles sub-basin is the Bonnet Carré Spillway, and included within it is the US 61 Recreation Area. The spillway offers a wide variety of aesthetic environments, including outstanding visual access provided for the Mississippi River, the western shore of Lake Pontchartrain, and the spillway structure itself, as well as views offered by I-10, which is situated along the western edge of the spillway where it enters Lake Pontchartrain. Within the spillway, the aesthetic environment is extremely varied

and includes areas almost denuded of vegetation, wide expanses of revegetated grasslands, innumerable water bodies of various sizes, BLH forests, and bald cypress/tupelo gum swamp.

Jefferson East Bank Sub-basin

The visual landscape of the Jefferson East Bank sub-basin project area is dominated by various flood and water control structures. Along the western shoreline portion of the sub-basin, the structures consist of floodwalls on the protected side and the shoreline is armored with riprap along the flood side. The shoreline runs along Parish Line Canal. Parish Line Canal is a man-made feature that was constructed by the dredging of the LaBranche Wetlands to the east. Both the canal and shoreline extend across Jefferson Parish and partially into St. Charles Parish. The landward view from the shoreline in the western portion of the sub-basin is dominated by the concrete floodwalls at the water's edge. The existing floodwalls are designed with a textured concrete in a designed pattern. The floodwall near Vintage Drive exhibits a steel-pile patch resulting from repairs of Katrina-related damage, which contrasts with the concrete architecturally treated floodwall found along the rest of the floodwalls. The northern portion of the Jefferson East Bank sub-basin is dominated by flood control structures that consist of an armored Lake Pontchartrain shoreline, a combination of earthen levees and floodwalls, as well as gates, four pump stations, and associated canals. In addition, the Lake Pontchartrain Causeway and its associated facilities on the shoreline are a major component of the man-made character of the Lake Pontchartrain shoreline.

The visual resources of the area include open vistas of the lake and shoreline across the northern portion of the Jefferson East Bank sub-basin, and the LaBranche wetlands in the western portion. The floodwall system on the western end partially obscures the views of the natural setting of the LaBranche Wetlands and Lake Pontchartrain, particularly from buildings that are not multistory. Between the levees and the shoreline in the northern portion of the sub-basin, Linear Park has an extensive lakefront pedestrian/bicycle path system which allows for viewing of these vistas. The view from the shoreline toward the protected side of the levee is dominated by earthen levees and stone/concrete riprap at the water's edge. The levee system on the northern portion of the sub-basin is relatively unobtrusive when compared to the floodwall system on the western portion of the sub-basin. The levees have a low relief with gradual slopes on both sides, and the levees are planted with grass that blends with the landscaping of the adjacent developed areas that is regularly maintained. The landward side of the floodwalls is planted with grass that blends in with the adjacent developed areas and is maintained regularly. In contrast, the four pump stations along with their associated fronting protection, floodwalls, and related structures are readily visible above the level terrain. Other obstructions of the open vistas include boat launches, a shoreline casino, high-voltage electrical transmission line towers, and a marina at the Causeway Bridge.

Inland within the sub-basin, the land is developed. Areas adjacent to the floodwalls and levees are dominated by single-family residential buildings. Non-residential areas are concentrated near Williams Boulevard in the western portion and at the North Causeway Boulevard and Bucktown in the eastern portion of the sub-basin. Other areas within the inland portion of the sub-basin that have visual resources include several parks that are administered by the Jefferson Parish Parks and Recreation Department, including Lafreniere Park, Linear Park, and the Bonnabel Boat Launch. These resources are described in more detail in the recreational resources section (section 4.2.10) of this document. Many of these parks contain green spaces that add to the intrinsic aesthetic quality of their representative areas.

Orleans East Bank Sub-basin

The project areas for the Orleans East Bank sub-basin lie within an expansive public green space that extends from the Lake Pontchartrain shoreline to the Senator Ted Hickey Bridge crossing. Flood and water control structures evident in this area include a mixture of floodwalls and levees, the ICS installed after Hurricane Katrina, gates, and four pump stations with their

associated outfall canals. The floodwalls are constructed utilizing a combination of concrete and metal sheet piling. Residents within the western portion of the Orleans East Bank sub-basin have raised concerns about the visual aesthetics of the ICS and how it contrasts with the adjacent flood control structures.

The entire landscape is man-made as part of an early 20th century reclamation project that created new land northward from the historic lakeshore near the current location of the Robert E. Lee Boulevard. Dredge material from Lake Pontchartrain was utilized along the shoreline to extend the historical shoreline north into the lake approximately 1,000 to 3,000 ft. The resulting shoreline was 5 to 10 ft higher than the lake level along with higher elevations occurring in conjunction with the levees and roadway ramps that cross them. By 2005, this green space was a mature landscape with a grass-covered hurricane levee system and a varied mix of mature trees consisting predominantly of live oaks, cypress, and pines. These were scattered over wide expanses of public spaces between the levees and private spaces. The parks along the shoreline allow views of Lake Pontchartrain, as well as Bayou St. John, which is part of the Louisiana Natural and Scenic River system.

A variety of recreational parks and other facilities are located within this expanse of green space (see figure 4-8). The Orleans Marina was constructed as part of the early 20th century reclamation project. Other parks and recreation areas located within shoreline green space include the West End Tennis Center, Retif Recreation Center, West End Park, Breakwater Park, and Lakeshore Park (see figure 4-8). The Orleans and London parks, located along the Orleans Avenue and London Avenue Outfall canals, respectively, provide a visual and physical connection from the public park areas along the lakeshore to the main east-west roadway set back from the shore. Both canals, as well as the 17th Street Canal, have ICS installed. Residents within the proximity of all three ICS have raised concerns about the impact of the ICS on local aesthetics, because it contrasts with the surrounding public green space and residential area. In response to community concerns, but not associated with the HSDRRS construction, the USACE performed a number of ICS landscape project enhancements to screen the pump stations from the local viewsheds and included the following:

- On the west side of London Avenue Canal between the levee and Pratt Drive, a planting design was implemented that included the Green Giant Arborvitae for heavy screening directly in front of and around the pump station. Other plant materials for streetscape improvements included live oak (to complete the neighborhood alley effect), oleander, holly, bald cypress, and two varieties of crape myrtle. To complete the pump station enhancement, a concrete grass paver system at the entrances to the facility was installed to keep gravel and other debris out of the main roadway and to improve driveway aesthetics.
- On the east side of Orleans Avenue Canal between the levee and Marconi Drive, a planting design was implemented that included the Green Giant Arborvitae for heavy screening directly in front of and around the pump station. On the west side of Orleans Avenue Canal between the levee and General Haig and Crystal Streets, the planting design utilized was similar to that at the London Canal west side landscape project. To complete the pump station enhancement, a concrete grass paver system was installed at the Orleans Avenue Canal pump station facility east side entrances similar to the London Avenue Canal enhancement, although on the west side of the pump station, a larger amount of concrete pavers were used to completely fill the driveway to the facility entrance.
- On the west side of 17th Street Canal, directly adjacent to the levee and 17th Street Canal, the planting design was dramatically different than at the other two pump stations and resembled more of an urban reforestation project. Species of plant materials differed

greatly and were grouped to gain maximum screening coverage and to provide the most natural variations of pattern and color. Plant materials included those mentioned previously, with exception of the Green Giant Arborvitae, and the addition of Blanchard Magnolia.

Other parks and recreation areas that potentially have a high aesthetic value include Harlequin Park, Tiara Park, Rome Park, Terrace Park, the Joseph M. Bartholomew Golf Country Club, City Park, City Park Golf Course, Fleur de Lis Park, and Tourmaline Park (see figure 4-8). Additional information about parks and other recreational areas can be found in the recreation section (section 4.2.10) of this document.

Much of the sub-basin is predominantly developed. Single-family residential structures make up the majority of the buildings on the protected side of the risk reduction structures. Neighborhoods such as the Lakeshore and Lake Terrace enjoy the park-like setting that is offered by the Lakeshore Park, as well as the Orleans and London parks. Multistory condominiums are present on the western portion of the sub-basin while facilities such as the main campus of the University of New Orleans exist on the eastern portion of the sub-basin near the project corridor areas.

New Orleans East Sub-basin

The western portion of the New Orleans East sub-basin's visual landscape along the Lake Pontchartrain shoreline is dominated by urban development, as well as risk reduction measures including earthen levees, architecturally treated floodwalls, floodgates, drainage canals, and pump stations. Dominant landscape features in the area include the Lakefront Airport, the Southshore Harbor Marina, and the remnants of Lincoln Beach and the Jazzland Amusement Park (see figure 4-8). Inland there is a mix of commercial, residential, and public service structures. Visually significant portions of the landscape within this western portion of the New Orleans East sub-basin include some small areas of green space located on the levees along the shore, as well as the Joe W. Brown Memorial, Kenilworth, and Goretta parks. More detailed information about the parks is presented in the recreation section (section 4.2.10) of this document.

The eastern portion of the sub-basin is largely undeveloped and dominated by the Bayou Sauvage NWR (see figure 4-8). The Bayou Sauvage NWR is approximately 23,000 acres and consists of a variety of habitats, including freshwater and brackish marsh, BLH forests, lagoons, canals, borrow pits, chenieres, and natural bayous. The undeveloped nature of this refuge allows for views of wide open vistas of various habitats and wildlife. Several highways cut across this refuge in the eastern portion of the sub-basin, including I-10, US 90, and US 11.

Six proposed borrow sites are located within the New Orleans East sub-basin. The Eastover Phases I and II sites are within two former 18-hole golf courses that have been closed. The Maynard site is wooded land that contains both invasive and native species, including Chinese tallow, red maple, boxelder (*Acer negundo*), and mulberry. The Cummings North site is also forested and is dominated by young Chinese tallow. The Stumpf Phase 1 and 2 sites were historically wetlands, but the area has been drained and converted to scrub/shrub habitat and is currently dominated by Chinese tallow. None of the proposed borrow sites contain distinct qualities that make them visually significant, and they are located in remote areas on private land that are inaccessible. As a result, they lack visual significance since their private land use does not allow for public access. The Eastover Phase II borrow pit is within the viewsheds of an existing neighborhood located to the west and southwest, as well as the East Point Court viewshed.

Chalmette Loop Sub-basin

Visually, the project area within the Chalmette Loop sub-basin is a contrast of natural and urban landscapes. The natural landscape is contrasted by unnaturally straight channels and spoil banks that cut through the coastal marsh. In addition, risk control measures such as earthen levees, floodwalls, and water control structures are evident across the project area in the Chalmette Loop sub-basin. Previous borrow areas for levee building material are also prevalent.

Primary viewpoints for the natural viewshed of Chalmette Loop sub-basin are from the numerous scenic streams within the sub-basin itself. The natural landscape is dominated by coastal marsh, low-lying natural levees, and small ponds and bayous. Several scenic rivers cross through the Chalmette Loop sub-basin, including Bayou Bienvenue, Bashman Bayou, Bayou Dupre, Terre Beau Bayou, Lake Borgne Canal, Bayou Chaperone, Violet Canal, and Pirogue Bayou (see figure 4-8). The LDWF describes these Scenic River corridors as being largely undeveloped and providing open vistas of solid and broken marshes interspersed with natural levees and spoil banks that support woody vegetation. Other recreational areas that are in or near the Chalmette Loop sub-basin that may have an enhanced visual value include the St. Bernard State Park, Parish Park, and Braithwaite Country Club. More detailed information on these resources can be found in the recreation section of this document (see section 4.2.10).

Belle Chasse Sub-basin

Visually the Belle Chasse sub-basin is characterized by a natural landscape that has been altered by rural and urban development. The western portion of the sub-basin is rural with natural visual attributes that are dominated by freshwater marsh, low-lying natural levees topped with BLH tree species, and bayous and other waterways. This vista of marsh continues into the JLNHPP within the newly incorporated Bayou aux Carpes CWA Section 404(c). Further south on the western edge of the Belle Chasse sub-basin lies the relatively straight man-made Hero Canal, which contrasts with the natural features of the area. The JLNHPP (also called the Baratavia Preserve) consists of a 28,600-acre preserve that includes bayous, swamps, marsh, and forests, which support an abundant wildlife population including alligators, nutrias, and over 300 species of birds. Along the Hero Canal, the project area is rural with waterways and canals, bordered by levees, marsh, bayous, forests, and farm fields. Intermittent open pastures are also found along this HSDRRS corridor.

The eastern portion of the sub-basin exhibits a more urban development around the Oakville area bounded by the Mississippi River and its earthen levee. Oakville exhibits a mix of single-family houses, manufactured homes, churches, and a small park. The land around the Hero Canal just north of Oakville presents a rather jumbled appearance with a mix of several industrial and commercial firms, as well as a landfill.

Gretna-Algiers Sub-basin

The visual landscape of the Gretna-Algiers sub-basin is dominated by urban development interspersed with flood risk reduction measures that include earthen levees, drainage canals, pump stations, and navigation canal locks and dams. On the protected side of the levee, the landscape is dominated by a mix of residential, commercial, and industrial development. Much of the commercial and industrial development is oriented to the maritime industry. Natural features dominate the unprotected side of the flood risk reduction measures. In the southern area of the sub-basin, adjacent to the GIWW, the area is predominantly undeveloped and is primarily BLH on the east bank of the GIWW and bayous on the west bank. Bayou aux Carpes CWA Section 404(c), found in the southwestern portion of the sub-basin, has been designated by the USEPA as a 404(c) because of its unique ecological features and is now a part of the JLNHPP.

Harvey-Westwego Sub-basin

The project area in the Harvey-Westwego sub-basin lies within a natural landscape that is characterized by wetlands and freshwater marsh interrupted by flood risk reduction measures

such as earthen levees, floodwalls, and pump stations. The JLNHPP is located south of the HSDRRS in this sub-basin. Construction of channels and borrow pits through the wetlands and marsh have resulted in spoil banks that are not naturally found within the project area. The marsh and wooded wetlands are comprised of a mixed BLH and cypress swamp dominated by a canopy of bald cypress and tupelo gum trees (water tupelo). Other dominant vegetation includes black willow, red maple, buttonbush (*Cephalanthus occidentalis*), palmetto, and wax myrtle.

Lake Cataouatche Sub-basin

The project area within the Lake Cataouatche sub-basin lies within a natural landscape that has been altered by urban development and the construction of flood risk reduction measures. Natural visual resources of the sub-basin include freshwater marsh and low-lying natural levees that are capped with BLH tree species, small ponds, and bayous.

Bayou Segnette State Park is located within the Lake Cataouatche sub-basin. The primary viewpoints into the eastern portion of the sub-basin project area are from the state park's roads, parking lots, and various recreational facilities, including boat launches and cabins located along the Outer Cataouatche Canal. Adjacent to the southernmost portion of the sub-basin lies Lake Cataouatche and Lake Salvador, as well as the Barataria portion of the JLNHPP. Both the lakes have open vistas surrounded by fresh and brackish water marsh. The Salvador/Timken WMA lies to the west and southwest of the sub-basin. The natural setting of the Salvador/Timken WMA is predominantly freshwater marsh with common marsh plants such as maidencane, cattail, bulltongue arrowhead, and numerous other aquatic plants. Additional information on the parks and other recreational areas can be found in the recreational section (section 4.2.10) of this document.

Potential Aesthetic Resources outside of the HSDRRS Sub-basin Boundaries **Ascension Parish**

The Bocage borrow site is currently cleared and maintained pasture land. Viewsheds to the proposed site are offered from LA 22, LA 942, Marchand School Road, and Walter Hill Road. The site, as pasture, fits in well with the surrounding area, which is dominated by low-density residential and agricultural land uses.

East Baton Rouge Parish

The Lilly Bayou site is located off of US 61 and a few small local streets that connect with the borrow site. Vegetation in the vicinity of the site is dense with a variety of trees and associated undergrowth. Vegetation density makes viewsheds to the site difficult to impossible either from the Mississippi River or US 61. Additionally, access to the actual project site is minimal and user activity is very low.

Iberville Parish

The St. Gabriel Redevelopment borrow area consists of cleared land that is currently overgrown pasture land. Vegetation on the site consists of bull thistle (*Cirsium vulgare*), yellow bristle grass (*Setaria pumila*), annual sumpweed (*Cyclachaena sp.*), arrow-leaf sida (*Sida rhombifolia*), eastern baccharis, and Johnson grass (*Sorghum halepense*). The borrow area is located on private land that does not allow for public access and is generally inaccessible.

Lafourche Parish

A variety of public access exists in and around the Raceland Raw Sugars borrow site and includes US 90, LA 308 and 182, and other local roadways. It is important to note that portions of LA 182 and 308 are a part of the Wetlands Cultural Trail, which is a state-designated scenic

byway. Vegetation within the borrow area is agricultural and cultivated lands with no trees or forestation. To the northeast of and bordering against three of the four borrow sites is a dense forested area that features a wide variety of tree types. Native grasses and some scrub/shrub make up the rest of the local plant life on the forest floor.

User activity is low in the immediate project area; however, the Wetlands Cultural Trail is important because it adds tourist traffic to the area. However, the lands are private and used for agricultural purposes and not open to the public. The terrain is unremarkable, and viewsheds that could be considered aesthetically pleasing are minimal.

Plaquemines Parish

Within Plaquemines Parish there are 15 borrow areas located outside of the HSDRRS. Viewsheds into many of the borrow areas exist from the nearby roads and highways. The Triumph borrow area is an expansion of an already approved borrow site and stockpile area, and is cleared of vegetation, limiting the aesthetic quality. The Bazile borrow area is highly visible from LA 39 and is adjacent to a residential area. The Citrus Lands and Idlewild Stage 1 and Stage 2 borrow areas are visible from LA 23, Conoco Phillips, and West Ravenna Road. The Nairn borrow area is visible from LA 23, US 11, and Shirley B. Drive. The Plaquemines Dirt and Clay borrow area is visible from Lacrosse Lane. The access to the Scarsdale borrow area is from LA 39, and is visible from the highway, with some parts of the borrow area and access road being blocked from a direct line of sight by vegetation.

St. Bernard Parish

St. Bernard Parish contains four borrow areas that are outside of the HSDRRS. The 4001 Florissant borrow area is cleared pasture land comprised of Johnson grass, vasey grass (*Paspalum urvillei*), and giant ragweed. The 1025 Florissant borrow area is comprised of both maintained and unmaintained pasture land, while Acosta 1 and 2 are maintained pasture land. The 1025 Florissant and the Acosta borrow areas are located near the San Bernardo Scenic Byway. The 29-mile San Bernardo Scenic Byway (on LA 46) is Louisiana's only State Scenic Byway in the Greater New Orleans Metropolitan Area. In St. Bernard Parish, the San Bernardo Scenic Byway meanders along the Mississippi River for approximately 25 miles and takes visitors past 19th century military barracks and the site of the Battle of New Orleans. Other visual resources located along the byway include ancient live oak and magnolia trees, plantation homes, and numerous historic cemeteries. Though there are restrictions to development along scenic byways, particularly for billboards and signage, developmental actions such as borrow pits are not restricted.

St. Charles Parish

Three borrow areas, Bonnet Carré Spillway (north), 3C Riverside (Site 1 and 2), and 3C Riverside Phase 3 borrow areas are located in St. Charles Parish outside of the HSDRRS sub-basins. The area around the Bonnet Carré Spillway borrow area has been disturbed by sand haulers maintaining the spillway, as well as existing borrow pits scattered throughout the area. Visual resources associated with the Bonnet Carré spillway have been discussed in more detail in the section on the St. Charles sub-basin. The 3C Riverside (Site 1 and 2) is cleared and currently utilized as farmland. The 3C Riverside Phase 3 has also been cleared of vegetation. The Bonnet Carré Spillway (north) borrow area is publicly accessible, and viewsheds of the area are offered from the maintenance roads, as well as the spillway levees. The 3C Riverside (Site 1 and 2) is adjacent to and within the viewshed of residential areas. The 3C Riverside Phase 3 borrow area is within the viewshed of LA 18, Mary Plantation Road/LA 3141, and LA 3127.

St. James Parish

The Big Shake borrow area is currently in active cultivation for sugarcane with minimal forestation. Viewsheds to the proposed borrow area are from two low-density residential areas to the south and east, as well as from LA 44. The small parcels of forest at the site do not serve as adequate buffers for these viewsheds.

St. John the Baptist Parish

Two HSDRRS borrow areas, Willow Bend and Willow Bend II borrow areas, are located in St. John the Baptist Parish. The Willow Bend borrow area consists of maintained pasture land, while the Willow Bend II borrow area contains a mix of unmaintained farmland and pasture land. Both the Willow Bend and Willow Bend II borrow areas are located on private land and are visually remote and inaccessible. The landscape of both areas lack distinct qualities that would make them visually significant.

St. Tammany Parish

Two borrow areas, the Tammany Holding and Levis sites, are located in St. Tammany Parish. The Tammany Holding site consists of three separate borrow areas and has been cleared as part of a residential development plan. The area has been heavily disturbed as part of the residential development process by drainage, roadbuilding, and other infrastructure. Another private borrow site also already exists within the central portion of the borrow area.

Areas adjacent to the Levis proposed borrow site are comprised of well-developed, urban environments with a mix of residential, commercial, and industrial uses. Access to the site is via I-10, US 190, and LA 433, and other local streets and roads that connect with or traverse through the adjacent project site. The local interstate and highways feature a drive with high visual interest and quality, but the viewsheds of the actual site are blocked by dense vegetation.

Hancock County

Six HSDRRS borrow areas are located in Hancock County, Mississippi. The Pearlington Dirt Phase 1 and 2 and Frierson borrow areas are forested. The Henley borrow area is a mixture of open pasture and other active borrow areas. The Kings Mine and Port Bienville sites are undeveloped with dense vegetation and nearby ponds, streams, and small rivers. The Port Bienville site is near an industrial channel. The area near the Kings Mine site also has what appears to be previous borrow efforts. Furthermore, the Henley borrow area contains other active borrow pits and is surrounded by heavy forest, which blocks the view of the Henley area. The Kings Mine site has no viewshed from local roads. All of the HSDRRS borrow areas in Hancock County, Mississippi, are privately owned, remote, and inaccessible. They lack visual significance since their private land use does not allow for public access.

4.2.11.2 Impacts of HSDRRS

4.2.11.2.1 HSDRRS 2011 Impacts

Construction of the HSDRRS and excavation of borrow sites adversely impacted aesthetic (visual) resources in the project area in the short-term in all sub-basins. The visual attributes of the project corridor were temporarily impacted by construction activities and by the associated transportation activities needed to move equipment and materials to and from the construction sites. After construction, the project corridor returned, to the maximum extent practicable, to pre-construction aesthetic conditions. Direct long-term impacts on visual resources from the HSDRRS improvements were negligible. The levees, floodwalls, and other risk reduction structures were similar in design and scale to existing structures, with the primary difference

being an increase in height of levees and floodwalls and an increase in scale of the majority of the gates, pump stations, and drainage structures. With construction of the HSDRRS, the appearance of the levees, floodwalls, and associated structures remained similar to what currently exists, only at a higher elevation.

Utilization of the borrow areas had an adverse effect on the viewshed of the surrounding areas during the time they were active. The establishment of a borrow area contrasted with the surrounding natural landscapes and water features. Loss of natural visual resources of the borrow areas themselves were the most acute where they were forested. Long-term direct impacts on the visual resources around the borrow areas depends on their final design and use. If stockpiled overburden for site restoration was utilized to create islands and smooth out corners, then these borrow sites had reduced adverse visual impacts.

Construction of the HSDRRS indirectly benefited visual resources in the area. A reduced risk of flood and storm damage to parks and other green spaces in the vicinity has been realized from the project completion. Furthermore, flood and storm damage risk has been reduced for many of the residential neighborhoods and surrounding structures and facilities that would otherwise be negatively modified by the impacts of storm surge and flooding.

When practical, risk reduction features were designed so that visual and human-cultural values associated with the project were protected, preserved, maintained, or enhanced. Mitigation measures that minimize impacts on aesthetics can be found in section 5.0.

St. Charles Sub-basin

Moderate permanent direct impacts on visual resources occurred with the implementation of the risk reduction measures. The levees, floodwalls, gates, and other flood control structures constructed were similar in design and scale to the existing risk reduction measures. However, a reduction of the vista outside of the risk reduction measures was experienced, but overall the appearance of the levees, floodwalls, and associated structures remained similar to what existed prior to construction.

Indirect impacts from the implementation of the risk reduction measures were moderate. Reduction in flood risk, coupled with the placement of some access roads that continue in use after construction, potentially facilitated development within the sub-basin and reduced the natural areas that provide visual screening of the risk reduction measures. This is a long-term adverse impact associated with the HSDRRS. However, any induced development in the area will largely be dependent on local government's ability to limit development in flood prone areas (see section 1.5, comment response #5).

Jefferson East Bank Sub-basin

Construction resulted in temporary impacts along the Lake Pontchartrain lakefront, where access to the vista of Lake Pontchartrain was restricted. After construction, turf grass was reestablished on the levees, and the appearance of the levees, floodwalls, and associated structures remained similar to the pre-construction conditions and only had a minor permanent impact on aesthetics. Beneficial impacts on the aesthetics of the sub-basin occurred with the replacement of patches to the risk reduction measures, which often visually contrast to the rest of the infrastructure, by the construction of new floodwall. A temporary sheet pile patch in the area near Vintage Drive,



Photograph 4-5. Aesthetic concrete stamping for floodwalls at the Williams Boat Launch.

which was put into place after Hurricane Katrina, visually contrasted with the original architecturally treated floodwall. With completion of floodwall construction, a visually coherent, architecturally treated floodwall system was utilized. An aesthetic concrete stamping process was used on floodwalls within the Jefferson East bank sub-basin as shown in photograph 4-5 (e.g., Williams Boat Launch).

Some new elements were added to the visual landscape as part of the HSDRRS and included an earthen ramp that replaced a gate, realignment of sections of floodwall, the addition of fronting protection, breakwaters, and floodwall tie-ins at pump stations #1, #2, #3, and #4, and extension of the existing levee system across Causeway Boulevard. These new elements had a long-term minor impact on aesthetic resources in the Jefferson East Bank sub-basin. All of the new elements were added to a viewshed already dominated by flood risk reduction measures. The impacts on the visual resources from the HSDRRS were minor.

Orleans East Bank Sub-basin

Implementation of HSDRRS resulted in adverse temporary impacts on aesthetic resources along the Lake Pontchartrain lakefront, where access to the vista of Lake Pontchartrain was restricted during construction. After construction, the project areas were returned to pre-construction conditions to the greatest extent practicable, and the associated structure (e.g., levees and floodwalls) remained similar to the pre-construction conditions, resulting in only minor permanent impacts. As a result, only negligible long-term impacts from levees on aesthetics occurred. Upon completion of the HSDRRS construction, a more visually coherent, architecturally treated floodwall system was put in place.

Moderate visual (aesthetic) impacts on the residents of the Mariner's Cove complex resulted from the temporary pump station and closure structure at the 17th Street Canal. The scale and proximity of these structures intruded into this residential and recreational area and introduced an industrial aesthetic that had the potential of being considered inconsistent with the surrounding area. Moderate impacts also occurred on the western side of the 17th Street Canal and were related to altered views from the Bucktown Marina complex and to the general aesthetic setting of the historic Bucktown area. Once constructed, the permanent pump station and closure structure would have similar impacts and create a dominating industrial presence at one of the prime viewsheds in the area, the Hammond Highway Bridge crossing. Prior to construction of the ICS, the views from the bridge were of an open connection to Lake Pontchartrain. After construction, the view of the lake would be disrupted by the new pump station and closure structure. Once constructed, the permanent pump stations and closure structures at the Orleans and London Avenue canals would also result in industrial-type structures being located in existing residential and park settings. The construction, operation, and maintenance of both the temporary and permanent structures have caused, and would continue to cause, localized visual and aesthetic impacts. Aesthetic impacts from the Orleans Avenue Canal were moderate in the Lakeshore community on the west side of the canal and minor to residents located to the east in the Lake Vista neighborhood, due to the canal's close proximity to these residential areas. Both residential areas, however, had already experienced negative aesthetic impacts, as well as disruptions to public use of the corridors along the levees in the past. Moderate aesthetic impacts on the Lake Terrace community on the west side of the canal and minor impacts on the University of New Orleans campus also occurred as a result of the temporary pump station and closure structures at the London Avenue Canal. Similar impacts would result following the construction of the permanent pump stations.

The floodwall sections were designed with an architectural treatment to the floodwall concrete, and the area adjacent to the floodwall was landscaped, where appropriate. An aesthetic concrete stamping process was used on various floodwalls within the Orleans East Bank sub-basin as shown in photograph 4-6 (e.g., Franklin Ramp). The long-term impacts on aesthetic resources in the sub-basin were moderate, as the project area was returned, to the maximum extent

practicable, to pre-construction conditions after the floodwall construction. However, the temporary pump stations and closure structures, and the future construction of permanent pump stations would permanently alter viewsheds in nearby residential areas.

New Orleans East Sub-basin

Construction modified 5 miles of the original 6.8 miles of earthen levee to new stretches of floodwall or earthen levee with a floodwall cap. The visual quality of the lakefront was altered by the construction of a floodwall in lieu of a vegetated levee, and this area is highly visible along Hayne Boulevard. However, the project area is highly urbanized, including roadways, railroad transportation corridors, and residential, commercial, and public services. As a result, only minor permanent impacts on aesthetics were anticipated from the implementation of risk reduction systems within the Orleans East Bank sub-basin.



Photograph 4-6. Aesthetic articulated fin finish for floodwalls at the Franklin Ramp.

A small portion of the 23,000-acre Bayou Sauvage NWR was directly impacted by the improvement of the risk reduction systems due to the construction of T-wall sections in the eastern and southernmost portions of the sub-basin. Given the remote nature of the western portion of the sub-basin, these long-term impacts were negligible.

Six HSDRRS borrow areas are located within the New Orleans East sub-basin. The majority of the borrow areas are remote and inaccessible to the public. Borrow areas within the New Orleans East sub-basin that had the greatest potential to impact aesthetic resources included Eastover Phase I and II sites (contractor-furnished borrow sites), where there are residential neighborhoods located to the west and southwest, as well as the East Point Court viewshed. The remaining four borrow sites are government-furnished borrow sites and as such could be designed as positive environmental features, where practicable. However, the Eastover Phase I and II sites borrow sites are contractor-furnished borrow areas and did not benefit from these mitigation measures; therefore, the long-term direct impacts on aesthetics from this borrow area depend on what the landowner decides to do with borrow area following excavation. As of July 2011, of the borrow sites located in the New Orleans East sub-basin, only the Maynard, Eastover Phase I, and Eastover Phase II borrow sites were utilized for the HSDRRS construction.

Chalmette Loop Sub-basin

New structures were larger and visible from a greater distance; however, much of the HSDRRS is located in remote and inaccessible areas, where the public has limited to no access. In addition, most HSDRRS improvements were within areas where similar risk reduction structures, navigation-related channel improvements, and other civil works projects already existed. As a result, overall permanent visual impacts from improvements to the HSDRRS were minor.

Several scenic rivers are located within the Chalmette Loop sub-basin; however, improvements to the HSDRRS took place outside the designated portions of these scenic rivers, and no long-term adverse impacts on visual resources of these areas occurred.

Nine HSDRRS borrow areas are located within the Chalmette Loop sub-basin. The majority of the borrow areas are remote and inaccessible to the public. Borrow areas within the Chalmette Loop sub-basin that had the greatest potential to impact aesthetic resources included the

Johnson/Crovetto (government-furnished borrow) and Contreras Dirt (contractor-furnished borrow) borrow areas, where there are viewsheds from residential areas and highways, and the borrow areas near the San Bernardo scenic highway. The Spoil Area (contractor-furnished borrow) would have impacts on the scenic quality of the area and viewsheds from scenic streams, primarily through recreational boating access to the site via roadway is severely limited. Most of the government-furnished borrow areas would be designed as positive environmental features, where practicable. However, the Contreras Dirt and Spoil Area borrow sites are contractor-furnished borrow areas; therefore, the long-term direct impacts on aesthetics from this borrow area depend on what the landowner decides to do with borrow area following excavation. As of July 2011, the Contreras Dirt borrow site located in the Chalmette Loop sub-basin was the only site utilized for the HSDRRS construction.

Belle Chasse Sub-basin

HSDRRS structures remained similar to the existing conditions, although they are larger and visible from a greater distance. The new floodgates and their associated transitional floodwalls and levees, levee segments, and pump stations are conspicuous visual features that have changed the pre-construction visual landscape. The improved risk reduction systems are located in remote and inaccessible areas with the exception of the new risk reduction systems replaced near LA 23. In addition, most improvements are within areas where similar risk reduction measures already existed and as such are not considered out of place. As a result, permanent impacts on aesthetics from improvements to the risk reduction systems were minor.

Gretna-Algiers Sub-basin

Following HSDRRS construction, the project area within the Gretna-Algiers sub-basin returned to pre-construction conditions, with structural components that were larger and visible from a greater distance. However, most of the structures are located in remote and inaccessible areas. In addition, most improvements were done within areas where similar risk reduction structures already exist and, as such, are not considered out of place. The area known as Bayou Aux Carpes CWA Section 404(c) was incorporated into the JLNHPP and is within and adjacent to the HSDRRS in this sub-basin. The viewshed into the project area from Bayou aux Carpes CWA Section 404(c) is limited; however, the area has a high aesthetic value due to its limited use and status as a CWA 404(c) area. Therefore, the direct and indirect permanent impacts on visual resources were moderate in areas very close to the project corridor, but minor from deep within the Bayou aux Carpes CWA Section 404(c) area. Permanent visual impacts from improvements to the HSDRRS were moderate.

Dredge material from the maintenance dredging of the Algiers Canal will be utilized in a marsh restoration project in the JLNHPP (IER #12). These dredged materials will be barged to the site from the Algiers Canal and placed in the JLNHPP "Geocrib" site in Lake Salvador. No adverse impacts were anticipated on aesthetic resources from disposal of this material.

Harvey-Westwego Sub-basin

The HSDRRS structures in the Harvey-Westwego sub-basin are in remote and inaccessible areas. In addition, most improvements were within areas where similar structures were previously present and are not considered out of place. Bayou aux Carpes CWA Section 404(c) and the JLNHPP, which are considered to have high aesthetic value, were impacted by the HSDRRS. Approximately 42 acres of cypress-tupelo swamp located within the JLNHPP were cleared for the implementation of the risk reduction system in the Harvey-Westwego sub-basin. Although the natural features of the cypress-tupelo swamp within the JLNHPP are considered to have high aesthetic value, there is limited visual access to the portions of the JLNHPP that were impacted. The impacted portions are located in areas with limited interior park roads and are removed from the Barataria Unit visitor trails and visitor center. As a result, the permanent visual impacts within the JLNHPP from improvements to the HSDRRS were minor. Other long-

term adverse impacts on aesthetic resources of the area were also minor. No borrow areas are located within the Harvey-Westwego sub-basin.

Lake Cataouatche Sub-basin

The improved HSDRRS structures remained similar to the existing conditions, although they are larger and more visible from a greater distance, but were located in remote and inaccessible areas. The Bayou Segnette State Park and the JLNHPP, which are considered to have a high aesthetic value, were directly impacted by the HSDRRS. Although floodwalls were constructed within Bayou Segnette State Park, they are located adjacent to a boat launch, pump stations, and a paved parking area. As a result, visual impacts from improvements to the HSDRRS were moderate.

The majority of the borrow areas are remote and inaccessible to the public. The Westbank E and F (government-furnished borrow), and Willswood (contractor-furnished borrow) borrow areas are in close proximity to residential areas. All the government-furnished borrow areas would be designed as positive environmental features where practicable. The Willswood borrow site is a contractor-furnished borrow area, so the long-term direct impacts on aesthetics from this borrow area depended on what the landowner decides to do with the site following excavation. As of July 2011, of the 12 borrow sites located in the Lake Cataouatche sub-basin, only five were utilized for the HSDRRS construction: Churchill Farms Pit A, River Birch Phase 2, South Kenner Road, Willswood, and River Birch Landfill Expansion.

Impacts from Borrow Sites Outside of the HSDRRS Sub-basins

The creation of borrow areas starkly contrasts with the natural landscape and, where visible to the public, adversely impacted the aesthetics of these areas. However, most of the borrow areas are located on private lands, in areas of limited viewsheds, or are remote and inaccessible to the public. The final design and function of the contractor-furnished borrow areas adopted by the landowner determines its potential long-term adverse or beneficial effects on the aesthetics of the surrounding area. Therefore, impacts on aesthetic resources were negligible at the following borrow areas: Bocage (Ascension Parish), Lilly Bayou (East Baton Rouge Parish), Raceland Sugars Raw (Lafourche Parish), 3C Riverside Phase 3 (St. Charles Parish), Big Shake (St. James Parish), Tammany Holding Area and Levis borrow site (St. Tammany Parish), King's Mine (Hancock County, Mississippi), and borrow areas in Plaquemines Parish (Bazile, Citrus Lands, Idlewild Stage 1 and Stage 2, Conoco Phillips, Nairn, and Plaquemines Dirt and Clay). The Bazile site is the only government-furnished borrow site that, at the end of its life, if practicable, will be developed into a positive environmental feature. The final design and function of the other borrow areas would be at the discretion of the landowners, and the ultimate reuse determines its potential long-term adverse or beneficial effects on the aesthetics of the surrounding area. Of these sites, only 3C Riverside Phase 3, Tammany Holding Area, Idlewild Stage 1, and Plaquemines Dirt and Clay were utilized by the HSDRRS construction, as of July 2011.

Long-term adverse impacts on aesthetics were negligible from the use of the following borrow areas: St. Gabriel Redevelopment (Iberville Parish), Willow Bend/Willow Bend Phase II (St. John the Baptist Parish), Pearlinton Dirt Phase I/Pearlington Dirt Phase II (Hancock County, Mississippi), Triumph, Kimble #2, Brad Buras, Tabony, Myrtle Grove, Tac Carrere, and Meyer (Plaquemines Parish). Specific details are listed below:

- St. Bernard Parish - Four borrow areas, the 4001 Florissant (government-furnished borrow), 1025 Florissant (contractor-furnished borrow), and Acosta 1 and 2 (contractor-furnished borrow) borrow areas, are located within St. Bernard Parish outside of the HSDRRS sub-basin boundaries. Three of the borrow areas, 4001 Florissant and Acosta 1 and 2, are located along the San Bernardo Scenic Byway, which is considered to have a high aesthetic value. Current restrictions for development along Louisiana Scenic

Byways apply only to signage and not to development actions such as borrow areas. The Florissant borrow areas are also located adjacent to and within the viewshed of residential areas. As of July 2011, only the Acosta 1 and 2 sites were utilized for the HSDRRS construction.

- St. Charles Parish - Three borrow areas, the Bonnet Carré Spillway (north) (government-furnished borrow), 3C Riverside (Site 1 and 2 - both contractor-furnished borrow), and 3C Riverside Phase 3 (contractor-furnished borrow) borrow areas, are located within St. Charles Parish outside of the HSDRRS project area. The Bonnet Carré Spillway (north) is located in an area that is heavily used for recreational activities and is considered to have a high aesthetic value. The 3C Riverside (Site 1 and 2) is located within the viewshed of a residential neighborhood and the 3C Riverside Phase 3 borrow area, though rural, is within the viewsheds of LA 18, Mary Plantation Road/LA 3141, and LA 3127. As of July 2011, all of these sites were utilized by the HSDRRS construction.
- The proposed Henley borrow site, a contractor-furnished borrow area, would temporarily impact aesthetic resources by construction activities related to implementing the HSDRRS borrow action and by transport activities needed to move equipment and materials to and from the site. Beyond the immediate project area, viewsheds from Old Picayune Highway would be further impacted from the implementation of the borrow site design. The Henley borrow site was not utilized by the HSDRRS construction as of July 2011.
- The Port Bienville borrow site, a contractor-furnished borrow area, had impacts on the scenic quality of the area and the viewsheds from scenic streams primarily through recreational boating, as access to the site, via roadway, is severely limited. As of July 2011, the Port Bienville borrow site was utilized by the HSDRRS construction.

4.2.11.2.2 HSDRRS 2057 Impacts

Where future levee lifts are required, they would further degrade the aesthetics of the surrounding areas due to the temporary lack of vegetation on the levee slopes and the increased height of the levees. In addition, temporary impacts on visual resources would occur during the actual implementation of the levee lifts when the area would contain construction equipment and staging areas. However, maintaining the earthen levees at 100-year risk reduction levels would provide a continued benefit to the region's aesthetic quality due to a reduction in properties damaged by both storm surges and flood events. The HSDRRS 2057 impacts on aesthetics would be minor.

Current HSDRRS borrow sites may not be utilized for future levee lifts, and new borrow sites may be required, which could further reduce the project area's aesthetic quality through the introduction of more disturbed borrow sites. Currently, the number and location of these borrow sites are unknown. However, prior to use of any new sites, the USACE would be required to fully investigate the proposed borrow area's setting and any impacts on the aesthetic quality of the surrounding area per the NEPA. In addition, the USACE would be required to follow any specific parish ordinances (e.g., Jefferson Parish) for these proposed borrow sites.

4.2.11.3 Cumulative Impacts

4.2.11.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Short-term adverse cumulative impacts on visual resources occurred, and would continue to occur, during all construction activities. Direct cumulative long-term impacts on visual resources from improvements to the risk reduction measures were minor, as most of the HSDRRS remained similar to what previously existed (levees, floodwalls, and associated

structures), only at a higher elevation. In a few cases the levee reaches were realigned into more rural settings, or over the decades have become a part of the area's visual landscape and provide more park-like linear features, which enhance the aesthetic quality of the HSDRRS project area. Additionally, the cumulative impact of the reduction of threat to property posed from flooding, along with the restoration of damaged facilities, parks, and associated infrastructure would be beneficial to the regional aesthetic resources.

The use of borrow sites for levee construction and for future levee lifts would have a cumulative minor impact on visual resources, because most borrow sites are located on private land with limited to no public access, and where borrow sites are not backfilled, open water habitats remain and in many cases are also aesthetically pleasing.

4.2.11.3.2 Cumulative Impacts of Present and Future Regional Actions

Storm Damage Reconstruction

In conjunction with ongoing efforts to restore existing floodwalls, floodgates, and levees throughout the HSDRRS project area, there are ongoing government- and community-based efforts to reconstruct damaged infrastructure, which would enhance the overall region's aesthetics. Although some of the projects might temporarily adversely impact the aesthetic resources in the area due to demolition, construction site equipment, and traffic congestion, in the long term, these enhanced facilities and related infrastructure would create a visually appealing presence, thereby contributing to an overall long-term beneficial impact on aesthetic resources in the area.

Community revitalization has been a central focus in rebuilding areas affected by the storm. The demolition, renovation, and rebuilding of homes and even whole neighborhoods enhances the visual and aesthetic resources in the project area by replacing the vision of a devastated, blighted, abandoned region with one of hope and recovery. The rebuilding of schools, hospitals and clinics, and fire and police protection facilities in the hurricane-affected areas would have a positive effect on aesthetic resources. Recreational infrastructure such as restored and newly created ball fields, playgrounds, and soccer fields would provide a vista of green space for individuals living nearby. Additionally, major and minor renovations on municipal buildings, parks, community centers, and street repair projects in St. Charles, Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany parishes would further provide individuals with outward visual cues indicating a region being restored and enhanced, which would have a positive effect on aesthetics as well.

Redevelopment

In general, redevelopment in all HSDRRS-affected parishes would result in beneficial long-term impacts on aesthetic resources in the region; however, short-term adverse impacts on visual resources due to these redevelopment construction activities, such as demolition, construction site equipment, and traffic congestion, would also occur. Redevelopment occurring in semi-pristine rural environments would have an adverse cumulative aesthetic impact, but would be a cumulative beneficial impact in a damaged region.

Projects such as Project Rebuild Plaquemines, are part of the redevelopment efforts and were started following Hurricane Katrina in 2005. Specifically, Project Rebuild helped rebuild three parks and construct one new park in Port Sulphur (Campbell 2010). These parks and others being rebuilt and restored throughout the HSDRRS project area would provide a vista of green space in the viewsheds of individuals living nearby. Other miscellaneous projects in the region providing opportunities to enhance visual appeal and aesthetic resources include the following: New Orleans Food and Farm Network, Parkway Partners and ReLeaf New Orleans, Bonnet Carre Spillway improvements, City of New Orleans park improvements, St. Charles Parish Land Use Plan, and FWHA Recreational Trail Program (see section 4.2.10.2).

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects benefit aesthetic resources by increasing natural viewsheds within the project area. Projects proposed, such as the Coastal Restoration Forest Initiative, would restore, protect, and conserve ecologically valuable lands in Louisiana's coastal forest system. Implementation of these types of projects would provide for new and improved aesthetics in forested ecosystems. The restoration of coastal habitats would allow native vegetation and wildlife to return to a previously disturbed area, which would increase the visual resources of the project area.

Flood Risk Reduction Projects

Historically, flood risk reduction projects have greatly altered the visual resources of southeast Louisiana. Cumulatively, ongoing and proposed flood risk reduction projects in the area would have adverse cumulative aesthetic impacts, as undeveloped lands are converted to risk reduction structures. Pump stations and other flood risk reduction infrastructure being built as part of SELA and NOV projects would not likely affect aesthetic resources because they would be constructed in areas currently used for flood risk reduction. These flood risk reduction projects would indirectly contribute to adverse impacts on aesthetic resources in the area through inducing development in undeveloped areas. They would also permanently impact viewshed opportunities within urban areas, and alter more pristine viewsheds within more rural and remote areas. However, these projects would cumulatively provide greater flood risk reduction throughout the HSDRRS project area, which in turn could have long-term beneficial impacts on aesthetic resources by reducing the frequency of storm surge devastation in the region.

Transportation

Numerous transportation projects would impact aesthetic resources, which would temporarily adversely impact those in the HSDRRS project area. Large transportation projects, if not planned with green spaces and adequate landscaping, could cause permanent adverse impacts on aesthetic resources.

The Huey P. Long Bridge widening project would substantially increase the size of the bridge and permanently impact visual resources in the area. However, because the bridge improvements are in alignment with the current bridge, and with the beneficial improvements to traffic flow, the impacts, although permanent, would be negligible. The Causeway Boulevard Interchange project at the junction of Causeway Boulevard and I-10 is constructing five new ramps to improve the efficiency and safety of this busy intersection. The addition of the new infrastructure would impact the visual resources of the area; however, the area is already heavily developed with urban buildings and roadways. The impact of the interchange project on visual resources, although permanent, would be negligible.

Most transportation projects would ultimately aid in traffic congestion reduction, which would in turn create a more positive urban viewshed and would create beneficial impacts on these same communities within the HSDRRS project area.

4.2.11.3.3 Summary of All Cumulative Impacts for Aesthetic Resources

Cumulative long-term impacts on visual resources are still evident from Hurricanes Katrina and Rita in the area, and include degraded, damaged, or destroyed homes, facilities, and recreational parks in the area. In general, all regional projects would have short-term moderate construction impacts on aesthetic resources. Most storm damage and redevelopment projects in the region would have beneficial cumulative impacts on visual quality after the post-construction phase. Flood risk reduction and coastal restoration projects would beneficially impact aesthetic resources and the overall visual viewsheds within the project area, as the risk for storm damage and flooding would be reduced and marshes are created or restored. New and restored infrastructure redevelopment projects would also benefit the aesthetic resources in the project

area by upgrading aging or failing infrastructure, which often contributes to a blighted visual quality within an area.

HSDRRS construction and the use of borrow sites have contributed to the permanent cumulative impacts on visual resources, but regionally, the cumulative impacts on aesthetics are negligible. Aesthetically enhanced floodwalls have been used in some locations, which minimizes the adverse degradation of the visual quality of HSDRRS structures, reducing the cumulative impacts on aesthetics.

4.2.12 Air Quality

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

4.2.12.1 Affected Environment

The enactment of the Clean Air Act of 1970 (CAA) resulted in the NAAQS and State Implementation Plans. The USEPA established NAAQS for specific pollutants to determine the maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare. The NAAQS standards are classified as either "primary" or "secondary" standards. The major pollutants of concern, or criteria pollutants, are carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), particulate matter less than 10 microns (PM-10), and lead (Pb). The NAAQS are included in table 4-23.

Areas that do not meet NAAQS standards are called non-attainment areas or maintenance areas, while areas that meet both primary and secondary standards are known as attainment areas. When a non-attainment area improves air quality, it becomes a maintenance area. The air quality managers in maintenance areas develop maintenance plans to ensure that air quality does not exceed the NAAQS presented in table 4-23.

In 1978, Orleans, Jefferson, St. Bernard, and St. Charles parishes were designated as in non-attainment for O₃ because the NAAQS air quality standards were exceeded for a period of time. Air quality improved in the 1980s, and the four parishes became a maintenance area, known as the New Orleans Ozone Maintenance Area. The USEPA redesignated the New Orleans Ozone Maintenance Area as attainment/unclassified for the 8-hour O₃ standard effective June 15, 2004; however, the area remained designated as a transportation maintenance area for O₃.

Conformity Determination

The Federal Conformity Final Rule (40 CFR Parts 51 and 93) states that Federal actions conform to Federal air quality regulations presented in the CAA. The rule mandates that a conformity analysis must be performed when a Federal action generates air pollutants in a region designated as a non-attainment or maintenance area for one or more NAAQS.

A conformity analysis determines whether a Federal action meets the requirements of the general conformity rule. It requires the responsible Federal agency to evaluate the nature of the proposed action and associated air pollutant emissions, calculate emissions as a result of the proposed action, and mitigate emissions if *de minimis* thresholds are exceeded. If the emissions exceed established limits, known as *de minimis* thresholds, the proponent is required to implement appropriate mitigation measures.

Table 4-23. National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Times
Carbon Monoxide	9 ppm (10 mg/m ³)	8-hour ⁽¹⁾	None	
	35 ppm (40 mg/m ³)	1-hour ⁽¹⁾		
Lead	0.15 µg/m ³ ⁽²⁾	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m ³	Quarterly Average	Same as Primary	
Nitrogen Dioxide	53 ppb ⁽³⁾	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour ⁽⁴⁾	None	
Particulate Matter (PM-10)	150 µg/m ³	24-hour ⁽⁵⁾	Same as Primary	
Particulate Matter (PM-2.5)	15.0 µg/m ³	Annual ⁽⁶⁾ (Arithmetic Average)	Same as Primary	
	35 µg/m ³	24-hour ⁽⁷⁾	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour ⁽⁸⁾	Same as Primary	
	0.08 ppm (1997 std)	8-hour ⁽⁹⁾	Same as Primary	
	0.12 ppm	1-hour ⁽¹⁰⁾	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour ⁽¹⁾
	0.14 ppm	24-hour ⁽¹⁾		
	75 ppb ⁽¹¹⁾	1-hour	None	

Source: USEPA 2010a at <http://www.USEPA.gov/air/criteria.html>

Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb - 1 part in 1,000,000,000) by volume, milligrams per cubic meter of air (mg/m³), and micrograms per cubic meter of air (µg/m³).

⁽¹⁾ Not to be exceeded more than once per year.

⁽²⁾ Final rule signed October 15, 2008.

⁽³⁾ The official level of the annual NO₂ standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard

⁽⁴⁾ To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

⁽⁵⁾ Not to be exceeded more than once per year on average over 3 years.

⁽⁶⁾ To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m³.

⁽⁷⁾ To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³ (effective December 17, 2006).

⁽⁸⁾ To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

⁽⁹⁾ (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as USEPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(c) USEPA is in the process of reconsidering these standards (set in March 2008).

⁽¹⁰⁾ (a) USEPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").

(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

⁽¹¹⁾ (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Greenhouse Gases and Climate Change

Global climate change refers to a change in the average weather on the earth. Greenhouse gases (GHG) are gases that trap heat in the atmosphere. They include water vapor, carbon dioxide (CO₂), methane, nitrous oxide (N₂O), fluorinated gases including chlorofluorocarbons and hydrofluorocarbons (HFC), halons, as well as ground-level O₃ (California Energy Commission 2007). The major GHG-producing sectors in society include transportation, utilities (e.g., coal and gas power plants), industry/manufacturing, agriculture, and residential. End-use sector sources of GHG emissions include transportation (41 percent), electricity generation (22 percent), industry (21 percent), agriculture and forestry (8 percent), and other (8 percent) (California Energy Commission 2007). The main sources of increased concentrations of GHG due to human activity include the combustion of fossil fuels and deforestation (contributing CO₂), livestock and rice farming, land use and wetlands depletions, landfill emissions (contributing methane), refrigeration system and fire suppression system use and manufacturing (contributing CFC), and agricultural activities, including the use of fertilizers (California Energy Commission 2007).

Final Mandatory GHG Inventory Rule

In response to the Consolidated Appropriations Act, 2008 (House Resolution 2764; P L 110–161), USEPA has issued the Final Mandatory Reporting of Greenhouse Gases Rule. The rule requires large sources that emit 27,557 U.S. tons or more per year of GHG emissions to report GHG emissions in the U.S., collect accurate and timely emissions data to inform future policy decisions, and submit annual GHG reports to the USEPA. The final rule was signed by the USEPA administrator on September 22, 2009, published on October 30, 2009, and made effective December 29, 2009.

Executive Order (EO) 13514

EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, signed on October 5, 2009, directs Federal agencies to reduce GHG emissions and address climate change in the NEPA analysis. It expands upon the energy reduction and environmental performance requirements of EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. It identifies numerous energy goals in several areas, including GHG management, management of sustainable buildings and communities, and fleet and transportation management.

The GHG covered by EO 13514 are CO₂, methane, N₂O, HFC, perfluorocarbons, and sulfur hexafluoride. These GHG have varying heat-trapping abilities and atmospheric lifetimes. CO₂ equivalency is a measuring methodology used to compare the heat-trapping impact from various GHG relative to CO₂. Some gases have a greater global warming potential than others. Nitrous oxides (NO_x), for instance, have a global warming potential that is 310 times greater than an equivalent amount of CO₂, and that of CH₄ is 21 times greater than an equivalent amount of CO₂.

GHG Threshold of Significance

The CEQ provided draft guidelines for determining meaningful GHG decision-making analysis. The CEQ GHG guidance states that if the proposed action would be reasonably anticipated to cause direct emissions of 27,557 U.S. tons or more of CO₂ GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. For long-term actions that have annual direct emissions of less than 27,557 U.S. tons of CO₂, CEQ encourages Federal agencies to consider whether the action's long-term emissions should receive similar analysis. CEQ does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHGs (CEQ 2010).

4.2.12.1.1 Existing Conditions

Orleans, Jefferson, Plaquemines, St. Charles, and St. Bernard parishes are in attainment for all NAAQS; however, the New Orleans Ozone Maintenance Area, which includes all or part of Orleans, Jefferson, Plaquemines, St. Charles, and St. Bernard parishes, is a transportation maintenance area for O₃, as previously mentioned (USEPA 2010b). Although transportation conformity regulations do apply for non-attainment and maintenance areas, the nature of the HSDRRS project does not fall under a transportation conformity (USEPA 2010b). The project is not intended to increase overall transportation capacity for the area, and does not result in short-term or long-term transportation planning for the area. Vehicle emissions consist of construction/hauling vehicles traveling on established roadways and emissions from construction equipment. Therefore, the air emissions generated by the HSDRRS actions do not trigger a transportation conformity determination if they exceed *de minimis* levels (100 tons per year).

4.2.12.2 Impacts of HSDRRS

4.2.12.2.1 HSDRRS 2011 Impacts

Temporary increases in air pollution from the HSDRRS projects occurred from three main sources: 1) emissions from transportation of construction materials to project sites such as clay fill, concrete and concrete piling, sheet pile, stone and rocks, etc; 2) combustion emissions from the engines of construction equipment, workers' automobiles commuting to work, and trucks shipping miscellaneous supplies to project sites; and 3) fugitive dust (PM-10) when soils were disturbed at the construction site. The following paragraphs describe the air calculation methodologies utilized to estimate air emissions produced by the construction of the HSDRRS.

Air Emissions Associated with Transportation of Building Materials

In order to construct the HSDRRS, substantial quantities of building materials needed to be brought to and transported within the Greater New Orleans Metropolitan Area. A transportation report and analyses were produced (USACE 2009r) describing the environmental impacts of transporting the materials necessary to construct the HSDRRS. The analyses addressed the effects of using public highways, railways, and waterways to supply materials to approximately 105 different construction projects associated with the HSDRRS.

The analyses were prepared using the engineering design reports for many of the projects that were not yet finalized (USACE 2009r). As such, the analyses of transportation effects were performed prior to the completion of the final design and were based on estimated material quantities deemed necessary to construct the HSDRRS (USACE 2009r). Estimated quantities were developed from design calculations, best professional judgment, and design reports completed for similar nearby levee and floodwall alignments (USACE 2009r).

The description of the projects, materials, and transportation analyses did not represent a formal commitment to final design, equipment for use, vendors for supply of materials, or methods of construction, but gave an approximation of how the materials needed could potentially be transported to the construction projects (USACE 2009r).

The MOBILE 6.2 model was used to quantify the emissions from the transportation of construction (building) materials for the HSDRRS based on the data from the transportation report. MOBILE 6.2 is an emission factor model for predicting gram per mile emissions of hydrocarbons, CO, NO_x, CO₂, PM, and toxics from cars, trucks, and motorcycles under various conditions (USEPA 2005a, 2005b, and 2005c). This analysis does not include non-road emissions from demolition and construction equipment used to build the HSDRRS, or the emissions from material transportation off of public roads within temporary work area easements or at construction sites. MOBILE 6.2 was used to generate emission factors for volatile organic compounds (VOC), CO, oxides of NO_x, exhaust PM, SO₂, ammonia (NH₃), and CO₂. The

model calculates emission rates under various conditions affecting in-use emission levels (e.g., ambient temperatures, average traffic speeds).

Although transportation conformity regulations do apply for non-attainment and maintenance areas, the nature of this project does not fall under a transportation conformity, so further requirements by the CAA general conformity rule (Section 176.(c)) did not apply (USEPA 2010b). Therefore, emissions were not segregated by parish or separated by the calendar year in which the emissions occurred. Table 4-24 presents the estimated air emissions from activities associated with transporting building materials such as earthen fill, concrete and concrete piles, sheet piling, aggregate, etc. (USACE 2009r).

Table 4-24. Estimated Air Emissions from Building Material Transportation to the HSDRRS

Pollutant	Total (tons/year)¹	<i>de minimis</i> Thresholds (tons/year)²
CO	373	100
VOC	131	100
NOx	3,062	100
PM-10	62	100
PM-2.5	57	100
SO ₂	239	100
Total CO₂ and CO₂ equivalents	1,200,114	27,557

Source: USACE 2009r.

¹ Total air emission values provided in this table are only approximate values estimated from USACE 2009r analyses.

² Note that Jefferson, St. Charles, Orleans, St. Bernard, Plaquemines parishes are in attainment for all NAAQS (USEPA 2010c). Also, note that *de minimis* thresholds are for each airshed.

Air Emissions Associated with the Construction of HSDRRS

Temporary increases in air pollution occurred from the use of construction equipment (combustion emissions) and the disturbance of soils (fugitive dust) during construction of the HSDRRS project components. The following paragraphs describe the air calculation methodologies utilized to estimate air emissions produced by construction activities.

Fugitive dust emissions were calculated using the emission factor of 0.19 ton per acre per month (Midwest Research Institute 1996), which is a more current standard than the 1985 PM-10 emission factor of 1.2 tons per acre-month presented in AP-42 Section 13 Miscellaneous Sources 13.2.3.3 (USEPA 2001).

USEPA's NONROAD Model (USEPA 2005a) was used, as recommended by USEPA's *Procedures Document for National Emission Inventory, Criteria Air Pollutants, 1985-1999* (USEPA 2001), to calculate estimated emissions from construction equipment. Combustion emission calculations were made for standard construction equipment, such as front-end loaders, backhoes, bulldozers, and cement trucks. Assumptions were made regarding the total number of days each piece of equipment was used, and the number of hours per day each type of equipment was used.

Construction workers temporarily increased the combustion emissions in the airshed during their commute to and from the project area. Estimated emissions from delivery trucks also contributed to the overall air emission budget. Estimated emissions from delivery trucks and construction worker commuters traveling to the job site were calculated using the MOBILE 6.2 Model (USEPA 2005a, 2005b and 2005c).

Ascension, Iberville, and East Baton Rouge parishes are in non-attainment for O₃. Air emission estimates associated with borrow construction activities in these parishes are segregated from the other parishes and sub-basins. A conformity assessment is presented in table 4-25. Details of the analyses are presented in appendix O. As can be seen from table 4-25, the construction activities in the non-attainment parishes did not exceed Federal *de minimis* thresholds, and thus did not require a Conformity Determination.

Table 4-25. HSDRRS Construction Air Emissions Analysis (in tons per year) for Parishes in Non-Attainment for Ozone¹

Parish (IER #)	VOC	CO	NOx	PM-10	PM-2.5	SO ₂	Total CO ₂
Ascension (32)	3.77	16.14	44.73	26.06	5.45	6.49	18,745
Iberville (19)	4.58	19.42	55.31	26.80	6.17	8.06	23,190
East Baton Rouge (31)	6.10	26.08	61.44	27.78	7.12	8.73	25,659
<i>de minimis</i> threshold	100	100	100	100	100	100	27,557

Source: USEPA 2010c

¹ Total air emission values provided in this table are estimations from modeled analyses.

The total estimated air quality emissions for all risk reduction and borrow IERs were calculated for construction activities. Summaries of the estimated total emissions for the HSDRRS projects are presented in table 4-26. Details of the analyses are presented in appendix O.

Table 4-26. Estimated Air Emissions (tons/year) from Construction Activities versus *de minimis* Threshold Levels

Pollutant	Total ¹	<i>de minimis</i> Thresholds ²
CO	3,962	100
VOC	906	100
NOx	9,447	100
PM-10	2,750	100
PM-2.5	908	100
SO ₂	1,286	100
Total CO₂ and CO₂ equivalents	3,910,040	27,557

Source: USEPA 2010a

¹ Total air emission values provided in this table are only approximate values estimated from USACE 2009r analyses.

² Note that Jefferson, St. Charles, Orleans, St. Bernard, Plaquemines parishes are in attainment for all NAAQS (USEPA 2010c).

Several sources of air pollutants contributed to the overall air impacts of the construction project. The results in table 4-26, located above, included emissions from:

1. Combustion engines of construction equipment,
2. Construction workers commuting to and from work,
3. Supply trucks delivering materials to the construction site, and
4. Fugitive dust from job site ground disturbances.

As mentioned above, the HSDRRS was not intended to increase overall transportation capacity for the HSDRRS project area, and was thus not reflected in short-term or long-term transportation planning for the area. Therefore, air emissions generated by the HSDRRS projects do not trigger a conformity determination if they exceed *de minimis* levels (100 tons per year).

As there are no violations of air quality standards and no conflicts with the state implementation plans, the impacts on air quality from the implementation of the HSDRRS were moderate.

The GHG emissions for the HSDRRS activities were estimated at 3.9 million tons a year, which is two orders of magnitude greater than the CEQ guidelines that state that 27,557 U.S. tons is the threshold at which agencies should consider further quantitative and qualitative assessment of GHG emissions (CEQ 2010). The implementation of the HSDRRS had a major short-term impact on the regional GHG budget.

Standard construction BMPs were used during the construction of the HSDRRS, including proper and routine maintenance of all vehicles and other construction equipment to ensure that emissions were within the design standards of all construction equipment. Dust suppression methods were utilized to minimize fugitive dust. In particular, wetting solutions were applied to construction areas to minimize the emissions of fugitive dust. Impacts on air quality in the region resulting from the implementation of the HSDRRS were temporary and minor. No permanent impacts on air quality occurred.

4.2.12.2.2 HSDRRS 2057 Impacts

An estimation of the present HSDRRS air quality impacts suggest that the future HSDRRS levee lifts would create a major impact on air quality if the New Orleans Maintenance Area becomes non-compliant with present-day NAAQS. It is difficult to determine if a low-emission fuel source will be available in the future or if air quality in the region would improve or get worse. The air impacts would be temporary, and emissions would be substantially less than from the HSDRRS 2011 construction since the number of simultaneous construction contracts would be substantially reduced for future levee lifts. Further, ambient air quality would return to background levels after the completion of future HSDRRS construction activities. Impacts associated with the future levee lifts and structural maintenance may be temporarily major, but would be negligible in the long term.

4.2.12.3 Cumulative Impacts

4.2.12.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

There would not be any permanent cumulative impacts on air quality. The air impacts would be temporary and ambient air quality would return to background levels after the completion of construction activities. However, if the New Orleans Maintenance Area becomes non-compliant, then major impacts on air quality would occur with the implementation of future HSDRRS construction.

4.2.12.3.2 Cumulative Impacts of Present and Future Regional Actions

A number of construction projects are occurring or are planned for the project area that would produce air emissions. These present and future regional actions would increase the ambient air pollution levels in the New Orleans Maintenance Area, and local citizens may experience an increased exposure to air pollution.

Other flood risk reduction construction projects could potentially increase and extend the time that local residents are exposed to elevated air pollution level. Levee construction projects scheduled for implementation to the west of the project area may have minor and temporary adverse impacts on the local air pollution levels, but would not likely impact the air quality near the HSDRRS project area due to timing and wind-induced dispersion and dilution.

4.2.12.3.3 Summary of Cumulative Impacts for Air Quality

The rebuilding and recovery efforts ongoing in the Greater New Orleans Metropolitan Area and throughout the Gulf Coast are creating large numbers of construction projects that would produce air emissions. These regional actions, combined with the HSDRRS construction, would increase the ambient air pollution levels in the New Orleans Maintenance Area, and local citizens may experience an increased exposure to air pollution. However, most of these emissions would occur primarily during construction activities and, therefore, would cause only short-term cumulative impacts on air quality. The ambient air quality should return to pre-construction conditions once completed, and permanent cumulative impacts on air quality would be negligible.

4.2.13 Noise

4.2.13.1 Affected Environment

This resource is institutionally significant because of the Noise Control Act of 1972. Compliance with noise emission regulations for surface carriers (motor vehicle and railroad) engaged in interstate transport is technically significant. Generation of noise levels in excess of applicable standards is publicly significant due to health and annoyance factors.

Noise is generally described as unwanted sound, which can be based either on objective effects (i.e., hearing loss, damage to structures, etc.) or subjective judgments (e.g., community annoyance). Sound is usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as sound level. The threshold of human hearing is approximately 3 dB, and the threshold of discomfort or pain is around 120 dB. Sound levels are typically expressed as A-weighted dB (dBA), which describes the relative loudness of sounds as perceived by the human ear.

Noise levels occurring at night generally produce a greater annoyance than do the same levels occurring during the day. People generally perceive intrusive noise at night as being 10 dBA louder than the same level of noise during the day. This perception is largely because background environmental sound levels at night in most areas are also about 10 dBA lower than those during the day. Noise levels are computed over a 24-hour period and adjusted for nighttime annoyances to produce the day-night average sound level (DNL). DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974). Acceptable DNL noise levels have been established by the U.S. Department of Housing and Urban Development (HUD) for construction activities in residential areas (HUD 1984):

Acceptable noise levels have been established by the HUD for construction activities in residential areas (HUD 1984):

- Acceptable (not exceeding 65 dBA) – The noise exposure may be of some concern, but common building construction will make the indoor environment acceptable, and the outdoor environment will be reasonably pleasant for recreation and play.
- Normally Unacceptable (above 65 dBA but not greater than 75 dBA) – The noise exposure is significantly more severe; barriers may be necessary between the site and prominent noise sources to make the outdoor environment acceptable; special building constructions may be necessary to ensure that people indoors are sufficiently protected from outdoor noise.

- Unacceptable (greater than 75 dBA) – The noise exposure at the site is so severe that the construction costs to make the indoor noise environment acceptable may be prohibitive, and the outdoor environment would still be unacceptable.

A DNL of 65 dBA is the impact threshold most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like construction. A DNL of 55 dBA was identified by USEPA as a level below which there is no adverse impact (USEPA 1974).

There are no noise ordinances at the state level; however, there are noise ordinances at the local level, including Orleans and Jefferson parishes. The maximum permissible sound levels by land use category are outlined in table 4-27. Sounds generated from construction and demolition activities are exempt from the New Orleans ordinance between 7:00 am and 6:00 pm (11:00 pm for areas other than residential) (Chapter 66 Article IV New Orleans Municipal Code). In Jefferson Parish, industrial sound level limits apply to construction activity for all land use categories. In addition, the Jefferson Parish ordinance specifically prohibits the operation of any construction equipment within 300 ft of any residential or noise-sensitive area between 9:00 pm and 7:00 am Monday through Saturday, and 9:00 pm and 8:00 am on Sundays and holidays, except for emergency work (Section 20-102 Jefferson Parish Municipal Code).

Table 4-27. Maximum Permissible Sound Levels by Receiving Land Use Category in Orleans and Jefferson Parishes

Receiving Land Use Category	Time	Sound Level Limit (dBA)		
		New Orleans		Jefferson Parish
		L ₁₀	L _{max}	L _{max}
Residential	7:00 am - 10:00 pm	60	70	60
	10:00 pm - 7:00 am	55	60	55
Commercial	7:00 am - 10:00 pm	65	75	65
	10:00 pm - 7:00 am	60	65	60
Industrial	At all times	75	85	75

Sources: Chapter 66 Article IV New Orleans Municipal Code (City of New Orleans 2011)
Section 20-102 Jefferson Parish Municipal Code (Jefferson Parish 2008)

L₁₀ = sound pressure level that is exceeded 10 percent of the time

L_{max} = maximum noise level of a particular event

4.2.13.1.1 Existing Conditions

Background Noise

Noise levels surrounding the HSDRRS are variable depending on the time of day and climatic conditions. Near many of the HSDRRS reaches, automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.

As a general rule, noise generated by a stationary noise source, or “point source,” will decrease by approximately 6.0 dBA over hard surfaces and 9.0 dBA over soft surfaces for each doubling of the distance. For example, if a noise source produces a noise level of 85 dBA at a reference distance of 50 ft over a hard surface, then the noise level would be 79 dBA at a distance of 100 ft from the noise source, 73 dBA at a distance of 200 ft, and so on. To estimate the attenuation of the noise over a given distance, the following relationship is utilized:

Equation 1: $dB A_2 = dB A_1 - 20 \log (d_2/d_1)$

Where:

$dB A_2$ = dBA at distance 2 from source (predicted)

$dB A_1$ = dBA at distance 1 from source (measured)

d_2 = Distance to location 2 from the source

d_1 = Distance to location 1 from the source

Source: California Department of Transportation 1998

Sensitive Noise Receptors

A number of parks, wildlife management areas, and wildlife refuges are located adjacent to or near the HSDRRS. These public lands are sensitive noise receptors where serenity and quiet are an important public resource. The Bayou Sauvage NWR and the JLNPP are located adjacent to the HSDRRS.

The areas with the greatest number of sensitive noise receptors, such as residential homes and apartments, schools, churches, and parks, are located in Orleans and Jefferson parishes. They are located adjacent to the HSDRRS reaches and are situated near Lake Pontchartrain, GIWW, and IHNC. In addition, a large number of residential sensitive noise receptors are located on the west bank of the Mississippi River in Jefferson Parish.

4.2.13.2 Impacts of HSDRRS

4.2.13.2.1 HSDRRS 2011 Impacts

No permanent noise impacts occurred as a result of HSDRRS construction, and all noise emissions were short-term, lasting only as long as construction activities. Table 4-28 presents noise emissions for construction equipment expected to be used during the HSDRRS construction activities. Anticipated sound levels at 50 ft range from 76 dBA to 91 dBA based on data from the FHWA (2007).

Table 4-28. A-Weighted (dBA) Sound Levels of Construction Equipment and Modeled Attenuation at Various Distances¹

Noise Source	50 feet	100 feet	200 feet	500 feet	1,000 feet
Backhoe	78	72	68	58	52
Crane	81	75	69	61	55
Dump Truck	76	70	64	56	50
Excavator	81	75	69	61	55
Front-end loader	79	73	67	59	53
Concrete mixer truck	79	73	67	59	53
Bulldozer	82	76	70	62	56
Pile driver	91	85	79	71	65

Source: FHWA 2007.

¹ The dBA at 50 ft is a measured noise emission. The 100 to 1,000 ft results are modeled estimates.

Several of the HSDRRS projects required the use of pile drivers or vibratory hammers to anchor the T-walls and these were the dominant noise source during construction activities. Assuming the worst case scenario of 91 dBA for actions that require the use of vibratory hammers or pile drivers, the noise model projected that such noise levels were required to travel 1,000 ft before they attenuated to acceptable levels of 65 dBA. To achieve an attenuation of 91 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor was 315 ft.

Some of the HSDRRS projects did not require the use of pile drivers or vibratory hammers, these reaches used earth-moving construction equipment, which produces noise emissions of 81 dBA. The noise model projected that noise levels of 81 dBA were required to travel 300 ft before they attenuated to acceptable levels of 65 dBA. To achieve an attenuation of 81 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor was 100 ft.

A number of sensitive noise receptors were located within 1,000 ft and 300 ft of the HSDRRS construction sites. Aerial photography was used to determine the number of sensitive noise receptors within the 1,000 ft and 300 ft zones. Table 4-29 summarizes the total sensitive receptors, segregated by sub-basins, IERs, and reaches that were temporarily impacted during construction of the HSDRRS. Table 4-30 summarizes the total sensitive receptors temporarily impacted during construction activities at the HSDRRS borrow pits.

Noise emission criteria for construction activities published by the FHWA has established a construction noise abatement criterion of 57 dBA for lands, such as NPS land, in which serenity and quiet are of extraordinary significance (23 CFR 722 table 1). The 57 dBA criterion threshold was used to measure the impacts from short-term noise emissions associated with constructing the HSDRRS adjacent to NPS lands. The noise model predicted that noise emissions of 91 dBA were required to travel 2,600 ft before they attenuated to 57 dBA.

Approximately 2,814 acres of land within the JLNHPP and 8,051 acres of land within Bayou Sauvage National NWR are within 2,600 ft of the HSDRRS. A number of state and city parks are located near the HSDRRS, including Bayou Segnette State Park, London Park, Ozone Park, Zephyr Park, Woodlake Park, St. Bernard State Park, Lake Shore Park, Pontchartrain Park, Lake Shore Park, Linear Park, and Williams Boulevard Park, and had the potential to experience noise emissions greater than 57 dBA.

Impacts on the ambient noise environment resulting from the implementation of the HSDRRS were major, but short-term. Approximately, 8,037 single-family homes, 268 apartment buildings, 20 churches, 26 schools, including the University of New Orleans, and three hospitals are located within 300 or 1,000 ft from the edge of the project corridors. These sensitive noise receptors experienced noise emissions greater than 65 dBA, which are normally unacceptable (HUD 1984). Contractors often worked 24 hours a day, 7 days a week. Those working in Orleans and Jefferson parishes obtained permission from local authorities to operate at times beyond local ordinance permissible time frames.

During storm events, the noise generated by the operations of the pump stations in the Orleans East Bank sub-basin (IER #5) will exceed the local ordinances. Sensitive noise receptors within these pump station areas included 98 single-family homes, four apartments, and one church. However, these unacceptable noise levels will only occur sporadically during storm events and, as such, were considered sporadic and infrequent adverse impacts.

Mitigation measures implemented by the USACE for HSDRRS impacts on noise can be found in section 5.2.

Table 4-29. Sensitive Noise Receptors Potentially Subjected to Construction Noise Emissions Equal to or Greater than 65 dBA

IER* #	Noise and Air Work Hours		Number of Sensitive Noise Receptors				
	Construction Contract Permissible Hours	Exceptions to Permissible Hours	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals
St Charles Sub-basin							
1/S 1	24 hr/day, 7 days/week operations permitted	Daylight hours only: LPV-03d.2	4	0	0	0	0
Jefferson East Bank Sub-basin							
2/S 2	24 hr/day, 7 days/week operations permitted	Pile driving limited to 7 am to 10 pm: all reaches	588	30	1	1	0
3/S 3.a	24 hr/day, 7 days/week operations permitted	No pile driving between 9 pm and 6 am: LPV-17.2, LPV-10.2, LPV-11.2, LPV-12.2, LPV-17.2	1385	48	2	1	1
Orleans East Bank Sub-basin							
4	7 am to 9 pm Mon-Fri, 8 am to 9 pm Sat & Sun	No pile driving between 9 pm and 6 am	460	46	2	6	2
Jefferson East Bank and Orleans East Bank Sub-basins							
5	24 hr/day, 7 days/week operations permitted	Pile driving limited to 7 am to 10 pm: LPV-101.02; 7 am to 9 pm Mon-Fri; 8 am to 9 pm Sat, no work Sun: LPV-103.01A2	98	4	1	0	0
27	24 hr/day, 7 days/week operations permitted**		1760	13	1	8	0
New Orleans East Sub-basin							
6/S 6	7 am to 9 pm Mon-Fri, 8 am to 9 pm Sat & Sun	No pile driving between 9 pm and 6 am: LPV-107	2063	62	4	4	0
7/S 7	24 hr/day, 7 days/week operations permitted	No pile driving between 9 pm and 6 am: LPV-109.02b; work on weekends & holidays must be requested: LPV-110	6	0	0	0	0

Table 4-29, continued

IER* #	Noise and Air Work Hours		Number of Sensitive Noise Receptors					
	Construction Contract Permissible Hours	Exceptions to Permissible Hours	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals	
11 Tier 2 Pontchartrain	7 am to 9 pm Mon-Fri, 8 am to 9 pm Sat & Sun	NA	0	0	0	0	0	
11 Tier 2 Borgne / S 11 Tier 2 Borgne	24 hr/day, 7 days/week operations permitted**	NA	0	0	0	0	0	
Chalmette Loop Sub-basin								
8	24 hr/day, 7 days/week operations permitted	NA	0	0	0	0	0	
9	18 hr/day (6 am to 12:00 am), 7 days/week operations permitted	NA	13	0	0	0	0	
10	24 hr/day, 5 days/week operations permitted, work on Sat & Sun requires 48 hr notice	No pile driving between 9 pm and 6 am: all reaches	19	0	0	0	0	
Belle Chasse Sub-basin								
13	7 am to 9 pm, 7 days/week at Pump Station #24, all other areas 24 hr/day, 7 days/week operations permitted	No pile driving between 9 pm and 7 am: WBV-09a, WBV-09b	49	0	3	0	0	
Gretna-Algiers Sub-basin								
12/S 12	24 hr/day, 7 days/week operations permitted**	No pile driving between 9 pm and 7 am: WBV-09b	411	65	0	4	0	

Table 4-29, continued

IER* #	Noise and Air Work Hours		Number of Sensitive Noise Receptors				
	Construction Contract Permissible Hours	Exceptions to Permissible Hours	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals
<i>Harvey-Westwego Sub-basin</i>							
14/S 14.a	6 am to 9 pm, 7 days/week: WBV-17.b.2, WBV-14.i, WBV-14.e.2; 24hr/day, 7days/week operations permitted: WBV-14.b, WBV-14.d, WBV-30, WBV-37	No pile driving between 9 pm and 7 am: WBV-14.b	800	0	3	0	0
<i>Lake Cataouatche Sub-basin</i>							
15	6 am to 9 pm, 7 days/week: WBV-17.b.2, WBV-14.i, WBV-14.e.2; 24hr/day, 7days/week operations permitted: WBV-14.b, WBV-14.d, WBV-30, WBV-37	NA	0	0	0	0	0
16/S 16.a	24 hr/day, 7 days/week operations permitted	No pile driving between 109 pm and 5 am: WBV-73, WBV-75, WBV-77	7	0	0	0	0
17	24 hr/day, 7 days/week operations permitted: WBV-24, WBV-16.b, WBV-20, WBV-22; 6 am to 9 pm, 7 days/week: WBV-16.2, WBV-21	NA	70	0	0	0	0
Total			7733	268	17	24	3

*S – Supplemental

**Used a worst case scenario of 24 hours/day, 7 days a week for these IER work hours.

NA – not applicable

Table 4-30. Sensitive Noise Receptors that were Subjected to Noise Emissions Equal to or Greater than 65 dBA near Borrow Sites

Borrow Sites Noise Emissions Work Hours and Locations		Number of Sensitive Noise Receptors						
HSDRRS Sub-basin or Parishes & IER* #	Construction Contract Permissible Hours	Exceptions to Permissible Hours	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals	
<i>New Orleans East Sub-basin</i>								
18, 19 29, 25	24 hr/day, 7 days/week operations permitted	None	13	0	0	0	0	
<i>Chalmette Loop Sub-basin</i>								
18, 19, 30, 31	24 hr/day, 7 days/week operations permitted	None	96	0	0	0	0	
<i>Belle Chasse Sub-basin</i>								
18, 22	24 hr/day, 7 days/week operations permitted	None	8	0	0	0	0	
<i>Lake Cataouatche Sub-basin</i>								
18, 19, 22, 25, 26, 28, 31	24 hr/day, 7 days/week operations permitted	None	123	0	2	2	0	
<i>Plaquemines Parish</i>								
18, 19, 22, 23, 25, 26, 28, 31, 32	24 hr/day, 7 days/week operations permitted	None	61	0	1	0	0	
<i>St Bernard Parish</i>								
18, 23, 31	24 hr/day, 7 days/week operations permitted	None	5	0	0	0	0	
<i>Hancock County</i>								
19, 23, 26, 31	24 hr/day, 7 days/week operations permitted	None	16	0	0	0	0	
<i>Lafourche Parish</i>								
31	24 hr/day, 7 days/week operations permitted	None	0	0	0	0	0	

Table 4-30, continued

Borrow Sites Noise Emissions Work Hours and Locations			Number of Sensitive Noise Receptors					
HSDRRS Sub-basin or Parishes & IER* #	Construction Contract Permissible Hours	Exceptions to Permissible Hours	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals	
<i>St Charles Parish</i>								
23, 32	24 hr/day, 7 days/week operations permitted	None	30	0	0	0	0	
<i>St James Parish</i>								
30	24 hr/day, 7 days/week operations permitted	None	24	0	0	0	0	
<i>St. John the Baptist Parish</i>								
26, 29	24 hr/day, 7 days/week operations permitted	None	1	0	0	0	0	
<i>St. Tammany Parish</i>								
29, 31	24 hr/day, 7 days/week operations permitted	None	3	0	0	0	0	
<i>Ascension Parish</i>								
32	24 hr/day, 7 days/week operations permitted	None	1	0	0	0	0	
<i>Iberville Parish</i>								
19	24 hr/day, 7 days/week operations permitted	None	0	0	0	0	0	
<i>East Baton Rouge Parish</i>								
31	24 hr/day, 7 days/week operations permitted	None	0	0	0	0	0	
Total			381	0	3	2	0	

*S - Supplemental

4.2.13.2.2 HSDRRS 2057 Impacts

Future levee lifts are planned to occur over the next 50 years. Provided that construction equipment noise emissions remain at 2011 levels, it is estimated that sensitive noise receptors would experience noise emissions greater than 65 dBA during construction of the planned levee lifts. Approximately 2,757 single-family homes, 120 apartment buildings, 13 churches, 10 schools, and three hospitals that are currently present in the project area would be exposed to noise emissions from future levee lifts that are normally unacceptable, as shown in table 4-31. While the noise emissions would create a major impact during construction activities, they would be temporary and sporadic (over 50 years), making the long-term impacts from noise emissions negligible.

Table 4-31. Sensitive Noise Receptors Impacted from Future Levee Lifts (HSDRRS 2057)

Estimate Noise Impacts 2057 HSDRRS	Number of Sensitive Noise Receptors				
	HSDRRS Sub-basin	Single-Family Homes	Apartment Buildings	Churches	Schools
St Charles	4	0	0	0	0
Jefferson East Bank	632	45	3	2	1
Orleans East Bank	460	46	2	6	2
Jefferson East Bank and Orleans East Bank	98	4	1	0	0
New Orleans East	1,206	23	2	2	0
Chalmette Loop	13	0	0	0	0
Belle Chasse	49	0	3	0	0
Gretna-Algiers	32	2	1	0	0
Harvey-Westwego	231	0	1	0	0
Lake Cataouatche	32	0	0	0	0
Total	2,757	120	13	10	3

4.2.13.3 Cumulative Impacts

4.2.13.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

Cumulative noise impacts associated with HSDRRS construction activities would be periodically major due to the number of sensitive noise receptors adjacent to the project areas; however, these impacts would be short-term, and would end when construction is completed. No permanent cumulative noise impacts would occur from HSDRRS construction.

4.2.13.3.2 Cumulative Impacts of Present and Future Regional Actions

A number of construction projects are occurring or planned for the region that would produce noise emissions. The construction activities for these projects would potentially increase the ambient noise levels in the HSDRRS project area and extend the time that local residents are exposed to elevated noise levels.

Storm damage reconstruction and redevelopment projects would potentially cause temporary adverse impacts in the HSDRRS area; should pile driving operations occur, those impacts could be major. If HSDRRS projects coincide with storm damage and redevelopment projects, then short-term adverse cumulative impacts would occur on sensitive noise receptors in the region.

Several other flood risk reduction projects are underway in southeast Louisiana. These construction activities would potentially increase the ambient noise levels in the region and extend the time that local residents are exposed to elevated noise levels; however, these conditions would predominantly be limited to the fringes of the HSDRRS project area. A number of other flood risk reduction projects are scheduled for implementation to the west of the project area. These projects may have minor and temporary adverse impacts on the local noise environment, but would not contribute to adverse cumulative impacts on the noise environment.

Transportation projects, such as new bridge crossings and the IHNC Lock replacement project, would require the use of pile driving equipment. If pile driving for bridge crossings or the lock construction coincides with the future levee lifts, the noise impacts could temporarily impact residential homes and other sensitive noise receptors near these construction sites. Other present and future transportation projects may have temporary adverse cumulative impacts on the local noise environment.

4.2.13.3.3 Summary of All Cumulative Impacts for Noise

Noise emissions associated with HSDRRS construction were major, but temporary. Approximately 8,037 single-family homes experienced noise emissions greater than 65 dBA, which are normally considered unacceptable (HUD 1984). During the future levee lifts, approximately 2,757 single-family homes would experience noise emissions greater than 65 dBA, which are normally considered unacceptable (HUD 1984). Noise emissions associated with HSDRRS construction and other regionally projects would be limited to specific locations of construction activities, and would be temporary in nature. No regional long-term cumulative noise impacts would occur.

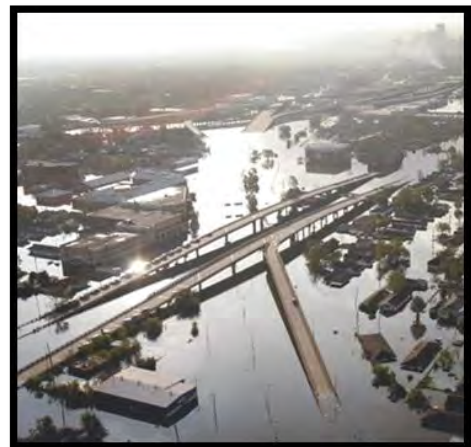
4.2.14 Transportation

The transportation network for the HSDRRS project area includes railways, shallow-draft waterways, and highways, as well as the streets and bridges supporting the local and regional communities. The transportation resource is important to the public because of the potential increase in traffic in relation to existing traffic load and capacity and a reduction in alternative transportation options during construction of the HSDRRS.

4.2.14.1 Affected Environment

Regional transportation in and around the HSDRRS project area includes air traffic systems, railroads, public transit, navigation channels, and roadway networks. Figure 4-10 shows the regional transportation features in the project area.

The roadway system within the New Orleans area has been in disrepair for years due to underfunding (Bureau of Governmental Research 2008). The landfall of Hurricane Katrina in 2005 made the situation much worse and resulted in the need for some immediate repairs (photograph 4-7). The South Louisiana Submerged Roads Program, a partnership between the New Orleans Regional Planning Commission (RPC), the City of New Orleans, LADOTD, and the FHWA to repair roads damaged as the result of Hurricane Katrina, is funded by the Emergency Relief Program of the FHWA, includes approximately 50 rehabilitation projects in Orleans, Jefferson, St. Bernard, Plaquemines and St. Tammany parishes, and is anticipated to cost approximately \$100 million (RPC 2010).



Photograph 4-7. Hurricane Katrina flooding in the City of New Orleans.

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Figure 4-10: Major Transportation Routes in the HSDRRS Project Area

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Airline Services

The Louis Armstrong New Orleans International Airport is located east of most projects in the HSDRRS and is the primary commercial airport for the New Orleans area and most of the Greater New Orleans Metropolitan Area. The New Orleans Lakefront Airport is located on the southern bank of Lake Pontchartrain along Hayne Boulevard and serves general recreation flights, private charter flights, a small aircraft flight school, and some military flights. The New Orleans Lakefront Airport serves southeastern Louisiana and the Mississippi Gulf Coast (New Orleans Lakefront Airport 2010).

Railroad Network

The New Orleans area is a central hub for many of the area's railroads. Southern Railroad, CSX Transportation Railroad, Canadian National Railroad, Norfolk Southern Railroad, Burlington Northern Santa Fe, and Union Pacific all have railroad lines in the vicinity of the HSDRRS project area. The New Orleans Public Belt Railroad connects with these six railroads on over 25 miles of main track, exclusively serving many of the Port of New Orleans facilities. It is a publicly owned and operated terminal switching railroad that is operated through the Public Belt Railroad Commission.

Passenger rail service is provided by Amtrak on three routes to and from New Orleans. The City of New Orleans route travels from Chicago to Memphis to New Orleans. The Crescent route travels from New York to Atlanta to New Orleans. The Sunset Limited route runs from New Orleans to San Antonio to Los Angeles.

Public Transit

The Regional Transit Authority provides public transit within the New Orleans area. There are 28 bus routes that are accessible to clients with disabilities and serve all regularly scheduled routes (Regional Transit Authority 2010). The city has three streetcar lines that have been active since the early 1900s, and a fourth line is under construction along Loyola Avenue between Canal Street and the Union Passenger Terminal. The streetcars have been an integral part of New Orleans public transportation network since 1923. Greyhound runs a bus service for regional transportation service from New Orleans. The New Orleans Greyhound station is located on Loyola Avenue. There are also several taxi cab companies that offer cab service, vehicles for hire, delivery service, and ground transportation.

Roadway Network

Roads and bridges compose the majority of the transportation network serving the HSDRRS project area. Included with this network are several LADOTD roadway classifications, including interstates, principal roads, and local roads.

Interstates

The I-10 corridor serves as an expressway for commuter traffic, as well as a regional interstate roadway serving east-west traffic from Florida to California. There is also a significant amount of commuting outbound from New Orleans to the petrochemical and oil refining industries along I-310 and the Mississippi River, as well as the shipbuilding industry. I-10 also connects New Orleans to Baton Rouge, the state capital. I-610 serves as a bypass from downtown New Orleans. I-510 connects I-10 to US 90 in New Orleans, as well as New Orleans East and Chalmette.

Principal Roads

There are several principal roads located throughout the project area. Some of these roads include US 61 (Airline Highway), US 90, US 11, LA 23, LA 47, LA 46, Causeway Boulevard, Veterans Boulevard, Metairie Road, Lakeshore Drive, Robert E. Lee Boulevard, Gentilly Boulevard, Lapalco Boulevard, Leon C. Simon Drive, Downman Road, and Hayne Boulevard.

Local Roads

Local roads are also used throughout the project area. Some important local roads include LA 39, LA 48, 17th Street, Orleans Avenue, London Avenue, Loyola Drive, Vintage Drive, Franklin Avenue, Marconi Drive, Bullard Avenue, and Read Boulevard.

Navigation channels

The Port of New Orleans, which moves about 500 million tons of cargo each year, is located on the Mississippi River (photograph 4-8) and connects with the IHNC and GIWW. The Port of New Orleans is one of the world's busiest ports, with many intersecting transportation modes (river and ocean vessels, rail, and highway). The Port is served by six railroad lines, 50 ocean carriers, 16 barge lines, and 75 truck lines (Port of New Orleans 2010).



Photograph 4-8. The Port of New Orleans moves nearly 500 million tons of cargo each year.

Level-of-Service

Operational conditions on a highway can be described with level-of-service (LOS). The Highway Capacity Manual (Transportation Research Board [TRB] 2000) describes LOS as a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six LOS are defined, with designations from A to F. LOS A represents the best operating condition, LOS C and LOS D are generally considered acceptable, and LOS F represents the worst operating condition. Each LOS represents a range of operating conditions and the driver's perception of those conditions. Safety is not included in the measures that establish LOS.

Heavy trucks can adversely affect the LOS of a highway. Heavy trucks are vehicles that have more than four tires touching the pavement and cover a wide range of vehicles, ranging from lightly loaded vans and panel trucks to the most heavily loaded coal, timber, and gravel haulers (photograph 4-9). Heavy trucks adversely affect traffic in two ways: 1) they are larger than passenger cars and occupy more roadway space, and 2) they have poorer operating capabilities than passenger cars, particularly with respect to acceleration, deceleration, and the ability to maintain speed on grades. The inability of heavy trucks to keep pace with passenger cars creates large gaps in the traffic stream, which are difficult to fill by passing maneuvers (TRB 2000).



Photograph 4-9. Heavy trucks hauling loads adversely affect traffic and LOS.

The LOS on most highways and streets in the project area was observed to be very poor during morning, noon, and evening peak hours, mostly due to commuter traffic, while vehicles were able to travel at the posted speed limits during off-peak times. Traffic volumes changed considerably after Hurricane Katrina in 2005. As of 2008, Orleans, Jefferson, and Plaquemines parishes all have more jobs than workers living in the parish, and therefore experience a net inflow of commuters. In contrast, St. Bernard is a "bedroom community," where workers live but commute to jobs in other parishes (Greater New Orleans Community Data Center [GNOCDC] 2010a). The commercial traffic volume also increased with the rebuilding of the area in the years following Hurricane Katrina. So, although the overall traffic volume decreased due to population leaving the area, there were large volumes of commuter and construction traffic throughout the general area.

4.2.14.2 Impacts of HSDRRS

4.2.14.2.1 HSDRRS 2011 Impacts

The *Transportation Report for the Construction of the 100-Year Hurricane and Storm Damage Risk Reduction System* prepared in 2009 describes the estimated quantities and anticipated impacts of transporting the materials necessary to construct the 100-year HSDRRS, and is incorporated by reference (USACE 2009r). All assumptions used can be found in appendix F of that report, which is herein referred to as the Transportation Report. There were a total of 105 projects analyzed in 17 risk reduction IERs for the HSDRRS. The material quantities, trips, and timing of trips were analyzed for the 105 HSDRRS projects. The total estimated material quantities for the projects are shown in table 4-32. The Transportation Report (USACE 2009r) and this analysis of impacts assumes a worst case scenario for estimating quantities, miles traveled, barge trips, and heavy equipment use. Even with those projects where construction has been completed (July 2011 completion), the exact number of truck trips and the distance traveled for each trip is not known. The construction contracts allowed the construction contractor to choose its preferred borrow pit from available environmentally cleared borrow sites. The sizes of the trucks used to haul materials are not known.

Table 4-32. Estimated Quantities of Major Materials Used for the HSDRRS Projects

Material	Quantity ¹
Earthen Fill (Borrow)	29,616,300 cy ²
Concrete	1,137,800 cy
Aggregate	3,307,200 tons
Sheet Pile	16,915,000 square ft
H-Pile	9,753,900 linear ft (lf)
Pipe Pile	1,066,700 lf
Concrete Pile	792,100 lf
Rock	1,733,200 lf

Modified from USACE 2009r.

¹ Quantities provided in this table are only approximate values estimated from information contained in USACE 2009r.

² The demand for borrow was reduced to about 24.3 million cy as project construction commenced (USACE 2011f)

³ Although exact quantities are not available at this time, it is likely that less earthen fill and more concrete were utilized for the New Orleans East and Chalmette Loop sub-basins for HSDRRS construction than are reflected in these quantity estimates.

In the Transportation Report, four transportation alternatives were developed to provide a range of different alternatives for assessment. They included maximum truck use (Max Truck), maximum barge use (Max Barge), maximum rail use (Max Rail), and the likely scenario (Likely Scenario), which identified the actions most likely to occur. The majority of all trips necessary to construct the HSDRRS were for the transportation of borrow material (earthen fill), and this material cannot be economically transported by rail or barge. The Likely Scenario routes materials from their point of origin to greater New Orleans on barges and trucks under the assumption that the choice of transportation mode was driven by transportation cost efficiencies and project access by water and over-land limitation (USACE 2009r). Since this was the alternative likely chosen, all analyses in this section of the CED were based on this Likely Scenario alternative. To predict transportation effects, the quantities of materials were compiled and converted to trips and miles per trip. Table 4-33 shows the miles traveled by mode and material for the Likely Scenario.

Table 4-33. Miles Traveled by Mode and Material for the Likely Scenario

Material	Truck Miles¹ (Local)	Truck Miles¹ (Non-Local)	Barge Miles¹
Earthen Fill (Borrow)	57,270,000	0	0
Concrete	408,000	0	0
Aggregate	1,922,700	310,600	203,300
Sheet Pile	138,500	3,385,300	96,600*
H-Pile	209,700	3,503,400	*
Pipe Pile	29,300	510,400	*
Concrete Pile	185,800	185,000	4,200
Rock	142,200	0	201,300
Total	60,306,200	7,894,700	505,400

Modified from USACE 2009r.

*96,600 barge miles includes Sheet Pile, H-Pile, and Pipe Pile combined.

¹ Quantities provided in this table are only approximate values estimated from information contained in USACE 2009r. Local travel is within the HSDRRS area; non-local travel is from outside the HSDRRS area.

Assessment of the environmental consequences from these four alternatives for material transport to and within the greater New Orleans Metropolitan Area for construction of the 100-year HSDRRS focused on four primary areas:

- effects on traffic congestion
- effects on transportation infrastructure (e.g., road surfaces, bridges, culverts)
- accident risks (increased risks of fatalities, injuries, and property damage accidents)
- diesel emissions

Transportation impacts were modeled and evaluated by attaching the number of truck trips per day, over the course of each project construction, to each road segment traversed, by the route carrying materials from the material origin to the roadway exit point, and returning to the origin. It is important to note that the Transportation Report did not predict traffic or road surface conditions on a particular segment of route on a given day in the overall project schedule. In order to assess effects on traffic, each route was parsed into segments according to LADOTD road classifications.

In general, the overall HSDRRS implementation caused adverse permanent and temporary impacts on transportation due to increased congestion, decreased LOS, accelerated roadway wear-and-tear, and increased risk of traffic accidents on major and local access roads in the project area and throughout the Greater New Orleans Metropolitan Area. Temporary impacts on transportation due to decreased LOS and increased traffic accident risk occurred during the construction period; however, these impacts no longer occurred after construction ended.

Permanent moderate impacts on transportation from infrastructure degradation occurred due to roadway wear-and-tear from the large volume of truck traffic required for the HSDRRS implementation. These impacts were likely greatest on local access roads and local bridges. Higher design characteristics for high capacity roads, such as major highways, are able to withstand wear much better than local roads. Federal, state, and local government entities could rehabilitate and repair roadways if needed.

According to the *USACE Report for Management of Traffic Impacts From Construction of 100-year HSDRRS for New Orleans, Louisiana*, prepared in February 2011, the number of roads used for delivery routes was fewer than predicted in the 2009 Transportation Report. The 2009 Transportation Report projected 170 roads to be used while the actual amount was 77 roads,

which was less than predicted. Fewer roads were involved that could be damaged. Principal arterial roads saw larger volumes, because trucks used these roads to access multiple projects (USACE 2011f).

Traffic Congestion

Congestion resulting from the implementation of the project was addressed using two methods: (1) using the RPC’s Congestion Management Index (CMI) and (2) by defining thresholds at which the public was likely to perceive the increase in traffic (i.e., truck frequency threshold) and identifying which specific roads exceeded those thresholds. The calculated changes in the CMI provided a relative assessment for the predicted changes in traffic, and with a greater change in CMI, congestion is predicted to increase more. Table 4-34 shows the congestion impacts for the Likely Scenario.

Table 4-34. Congestion - Likely Scenario

LADOTD Road Classification	Class Description	Maximum Change in CMI	Number of Roads Exceeding Truck Frequency Thresholds
1	Interstate	0.007	0
2	Expressway	0.048	0
3	Principal Arterial	0.031	6
4	Minor Arterial	0.036	12
5	Urban Collector	0.000	8
8	Local Road	0.023	32

Modified from USACE 2009r.

The thresholds shown in table 4-35 show the level of truck traffic at which the roadway users and adjacent property owners were likely to perceive an increase. Functional road classes 1 and 2 are estimated to have a substantially higher frequency of trucks, potentially increasing traffic and damaging roadways.

Table 4-35. Truck Frequency Thresholds by Functional Road Class

Functional Road Class	Materials Transportation Trucks Per 12-Hour Workday	Truck Frequency
1	1,500	30 seconds
2	1,500	30 seconds
3	360	2 minutes
4	240	3 minutes
5	150	5 minutes
8	50	15 minutes

Modified from USACE 2009r.

The roads listed in the following tables (tables 4-36, 4-37, 4-38, and 4-39) were those predicted to be the most affected by increases in truck traffic and the durations for which those effects were expected. No thresholds were exceeded for any Interstate and Expressway routes in the region. Roadways that experienced actual large truck volume increases were US 61 in St. Charles Parish, US 90 in St. Charles and Jefferson parishes, and US 11 and US 90 in Orleans Parish - New Orleans East (USACE 2011f).

**Table 4-36. LADOTD Road Class 3 – Threshold of Material Delivery Trucks
Per Day Exceeded**

Roadway	Number of Months Threshold Exceeded	Minimum Trucks Per Day	Average Trucks Per Day	Maximum Trucks Per Day
US 90	15	360	1,064	2,252
Lapalco Boulevard	8	497	738	1,250
LA 39	7	372	445	457
US 61	6	383	458	640
LA 23	3	381	425	543
Walker Road	1	378	378	378

Modified from USACE 2009r.

**Table 4-37. LADOTD Road Class 4 – Threshold of Material Delivery Trucks
Per Day Exceeded**

Roadway	Number of Months Threshold Exceeded	Minimum Trucks Per Day	Average Trucks Per Day	Maximum Trucks Per Day
US 61	25	251	840	2,570
US 11	16	287	659	1,043
US 90	16	289	661	1,047
Michoud Boulevard	16	287	657	1,039
LA 46	12	264	459	698
Bayou Road	9	240	267	298
Ames Boulevard	8	326	842	2,147
Westwood Drive	7	291	653	1,248
Engineers Road	5	269	270	273
LA 3134	3	349	349	349
LA 45	3	347	348	349
Lakeshore Drive	2	268	315	346

Modified from USACE 2009r.

**Table 4-38. LADOTD Road Class 5 – Threshold of Material Delivery Trucks
Per Day Exceeded**

Roadway	Number of Months Threshold Exceeded	Minimum Trucks Per Day	Average Trucks Per Day	Maximum Trucks Per Day
LA 45	9	160	562	1,808
Bayou Road	9	240	267	598
Ames Boulevard	8	347	347	347
Westwood Drive	8	189	588	1,248
41 st Street	3	190	190	190
Vintage Drive	3	190	190	190
Ames Boulevard	3	347	347	347
Barriere Road	2	382	382	382

Modified from USACE 2009r.

Table 4-39. LADOTD Road Class 8 – Threshold of Material Delivery Trucks Per Day Exceeded

Roadway	Number of Months Threshold Exceeded	Minimum Trucks Per Day	Average Trucks Per Day	Maximum Trucks Per Day
Kenner Avenue	29	76	612	2,146
LA 46	27	100	332	698
Live Oak Boulevard	25	127	555	1,676
Bayou Road	19	62	144	298
Walker Road	19	52	198	756
Vintage Drive	18	52	126	348
Lapalco Boulevard	12	60	422	1,248
Concord Road	11	60	104	153
Engineers Road	11	52	142	273
Victory Drive	11	85	432	1,188
Macarthur Avenue	10	52	58	69
Almonaster Avenue	9	108	108	108
LA 3134	8	52	174	349
Carrie Lane	8	50	172	347
Mildred Street	8	57	167	392
40 th Street	7	52	109	174
Loyola Drive	7	52	109	174
Beta Street	7	92	92	92
Laroussini Street	7	92	92	92
North Street	7	92	92	92
South Street	7	92	92	92
Vic A Pitre Drive	7	92	92	92
Caryota Drive	7	54	122	190
David Drive	7	54	122	190
Barrier Road	6	57	159	375
LA 23	5	165	165	165
Nashville Avenue	4	50	61	94
Hickory Avenue	3	95	95	95

Modified from USACE 2009r.

The maximum daily truck trips were higher than expected due to schedule slippage of specific large construction projects requiring large volumes of borrow material. This resulted in more trucks in an area but for a shorter period of time. The overall number of truck trips was less than projected and was likely due to design changes that replaced earthen levees with concrete floodwalls (USACE 2011f). It should be noted that detailed transportation routing plans were not available during the preparation of this document; therefore, a more detailed LOS analysis for minor highways and access roads has not been prepared.

Infrastructure Degradation

The effects on infrastructure are a function of vehicle axle configuration, load, number of trips, road design, and the pre-project condition of the road. Between 1,100 and 1,300 land miles of roadway within Greater New Orleans Metropolitan Area were traversed, with between 2.19 and 2.35 million truck trips. The facility designs for minor arterial, urban collector, and local roads are not designated to support frequent heavy loads. The effects of extensively using these roads to haul large quantities of heavy loads accelerated the wearing of road surfaces, bridges, and culverts, as shown in table 4-40.

Table 4-40. Infrastructure - Likely Scenario

LADOTD Road Classification	Length in Miles	Miles of Infrastructure Degradation*
1	111.9	335.6
2	32.1	64.3
3	240.8	481.5
4	109.0	311.3
5	21.4	30.6
8	40.4	57.7

*Includes 12 ft lane miles

Modified from USACE 2009r.

The estimated infrastructure costs for the Likely Scenario, assuming that all lane miles used for truck transportation needed repair after the project was complete, was estimated as \$645.8 million. This cost was based on the cost of \$500,000 per lane mile derived from the Submerged Roads Program and included repair to road surfaces and crossings within the roadway.

Accident Risks

Transportation risks were estimated for each of the transportation alternatives. For each alternative, the total collective risk for property damage only, injury only, or fatalities represents the aggregate of risks from each mode of transportation assumed under that alternative. The projected accidents for the Likely Scenario based on 68.9 million miles traveled include: 106.2 accidents with property damage only, 35.1 accidents with injury only, and 1.4 accidents with a fatality. However, if less material is needed than projected for the Likely Scenario, then less miles will be traveled in hauling material, and accident risks would be reduced as well.

The following is a discussion of the impacts of the HSDRRS on transportation. IERs #1 through #17 (and their Supplementals) are broken down by sub-basins, while IERs #18 through #32 are shown by parish. Worker and truck traffic resulting from the HSDRRS projects temporarily impacted traffic on roadways within the vicinity of each IER project area. There will be no long-term effects on transportation accident risks after construction is complete.

Mitigation efforts for the HSDRRS impacts on transportation are discussed in section 5.0.

Sub-basins (Risk Reduction: IERs #1 through #17, and #27)

St. Charles Sub-basin

The main highway utilized in this sub-basin was US 61. US 61 and access roads (e.g., terminal access, staging areas) used by trucks had substantial changes in their LOS. The construction of the project was estimated to have required 2,874,600 total local truck miles and 1,036,350 total non-local truck miles (USACE 2009r; appendix F). There was no barge use for the projects described in IER #1 (LaBranche Wetlands Levee).

Impacts on highway capacity can be predicted using the methodology from the *Highway Capacity Manual* for multilane highways (TRB 2000). Two models were built for IER #1, the Base and the Additional Truck model. These models evaluated the highway capacity impacts that additional trucks had on US 61. For comparison purposes, the Base model looked at future conditions with no action. The Additional Trucks model looked at the future conditions where the calculated number of trucks supporting the construction of projects described by IER #1 operated (based on the amount and types of construction materials that needed to be transported), in addition to the Base traffic stream during the peak hour.

It was assumed that there were 30,000 vehicles per day in the Base condition, 10 percent of which operated in the peak hour. Five percent of the Base vehicles were trucks, and Base free-flow speed was set at 50 miles per hour (mph). For the Additional Trucks condition, 62 trucks per hour in each direction were added to the Base condition. For both the Base and Additional Trucks conditions, US 61 operated at LOS C, with an average vehicle speed of 49 mph. The additional truck traffic likely had an adverse short-term impact on the LOS for US 61 during the construction period. US 61 was used heavily and experienced large traffic volume increases during the project construction. After construction was complete, moderate permanent impacts occurred due to infrastructure degradation.

Projects described by IER Supplemental #1 had impacts similar to those described for IER #1, with the exception of additional short-term direct impacts on traffic associated with the HSDRRS access roads perpendicular to US 61, which included Shell Access Road 2 and Cross Bayou Access Road, for LPV-04 and 05. The outer lane of US 61 was closed during the pile driving activity for a few hours each day, throughout consecutive days, for 4 to 5 weeks.

Jefferson East Bank Sub-basin

For the projects described in IER #2 (West Return Floodwall), truck access to the project site was via I-10 to Loyola Drive to either Veterans Memorial Boulevard, West Esplanade Avenue, or Vintage Drive. Barges were used during construction and were accessed via Lake Pontchartrain to the Parish Line Canal. The construction of the projects described by IER #2 is estimated to have required approximately 512,900 total local truck miles and 39,240 total barge miles (USACE 2009r; appendix F). There were no non-local truck miles. The major roadways had no major adverse short-term impacts in their LOS, but the access roads potentially had substantial changes in their LOS, resulting in minor short-term impacts.

Impacts for projects described by IER Supplemental #2 were similar to those described for IER #2.

The HSDRRS construction components described for IER #3 (Lakefront Levee, Jefferson Parish) had truck access to the project sites via I-10 to Loyola Drive, to Vintage Drive, to Bonnabel Boulevard, to Causeway Boulevard, or to Williams Boulevard. Most of the truck traffic used US 61 and I-10. Barges were also used during construction and accessed the project area via Lake Pontchartrain. The construction of the projects described by IER #3 was estimated to have required 1,851,900 total local truck miles, 1,068,130 total non-local truck miles, and 59,510 total barge miles (USACE 2009r; appendix F). The additional truck traffic had an impact on the LOS of US 61, and the access roads potentially had major adverse short-term impacts on their LOS.

Using the above-mentioned model (TRB 2000) for both the Base and Additional Trucks conditions, US 61 operated at LOS C, with an average vehicle speed of 49 mph during the project construction period. The additional truck traffic had a short-term impact on the LOS for US 61. After the construction of projects described by IER #3 was complete, the HSDRRS action had a moderate permanent impact due to infrastructure degradation.

Impacts for the projects described by IER Supplemental #3.a were similar to those described in IER #3.

Orleans East Bank Sub-basin

Truck access for the projects described by IER #4 (New Orleans Lakefront Levee) to the project sites along Lakeshore Drive were via I-610 or I-10 to Pontchartrain Boulevard, West End Boulevard, Canal Boulevard, Wisner Boulevard, St. Bernard Avenue, Paris Avenue, Gentilly

Boulevard, Elysian Fields Avenue, and Franklin Avenue. Most of the earthen fill truck traffic used US 61, I-10, and I-610. The additional truck traffic had adverse short-term impacts on the LOS for US 61, and potential moderate adverse short-term impacts on the LOS for local streets used to access work sites. The construction of the projects described by IER #4 required 1,506,000 total local truck miles, 733,890 total non-local truck miles, and 820 total barge miles.

The construction of the projects described by IER #5 (Outfall Canal Closure Structures) were estimated to require 42,300 total local truck miles, 9,060 total non-local truck miles, and 2,840 total barge miles (USACE 2009r). It is known that no barges have been utilized for construction for any projects described by IER #5; therefore, more material was likely brought to the project area by truck than estimated in USACE 2009r (appendix F). Moderate short-term impacts included temporary road closures and congestion in those areas where project construction occurred. Some roads were temporarily closed during transportation of construction materials or because of construction activities (i.e., bridge reconstruction or replacement). These temporary closures resulted in increased congestion of those roads in the vicinity not directly impacted by construction activities. Roads directly impacted by the HSDRRS at the 17th Street Canal potentially included Hammond Highway, Pontchartrain Boulevard, West End Boulevard, and I-10/I-610. Roads directly impacted by the HSDRRS projects at the Orleans Avenue Canal could include Lakeshore Drive, Robert E. Lee Boulevard, Canal Street, Marconi Drive, and I-10/I-610. Roads directly impacted by the HSDRRS at the London Avenue Canal potentially included Lakeshore Drive, Paris Avenue, Elysian Fields Avenue, and I-10/I-610. The impacts were considered short-term, lasting only as long as the time frame necessary to complete the construction activity. After construction of the projects described by IER #5 was complete, the project had moderate impacts due to infrastructure degradation.

Truck access to the project sites described by IER #27 (Outfall Canal Remediation) included Hammond Highway, Pontchartrain Boulevard, West End Boulevard, I-10, I-610, Lakeshore Drive, Robert E. Lee Boulevard, Canal Street, Marconi Drive, Paris Avenue, Leon C. Simon Drive, and Elysian Fields Avenue. Bridges along those roadways were also impacted. Adverse short-term impacts included short-term road closures and congestion in those areas where construction occurred. The local bridges over the outfall canals were closed on a short-term basis to lower segmented barges, equipment, and materials into the canal. One or both lanes were temporarily closed. These short-term closures resulted in increased congestion of roads in the vicinity not directly impacted by construction activities.

New Orleans East Sub-basin

Truck access to the project sites described by IER #6 (Citrus Lakefront Levee) and IER Supplemental #6 included Downman Road, Crowder Boulevard, Read Boulevard, Bullard Avenue, Hayne Boulevard, LA 47, and I-10. The construction of the projects described by IER #6 was estimated to have required 572,100 total local truck miles, 974,780 total non-local truck miles, and 27,700 total barge miles (USACE 2009r; appendix F). However, it is known that no barges were utilized for any construction described by IER #6; therefore, the truck miles are likely greater than those estimated in appendix F for these construction projects. Segments of the two westbound lanes of Hayne Boulevard were temporarily closed during construction. A short-term and minor reduction in LOS on some local road segments was anticipated, resulting in negligible, adverse short-term impacts. No impacts on the operation of the New Orleans Lakefront Airport occurred.

Truck access to the project sites described by IER #7 (New Orleans East Levee) included Hayne Boulevard, Paris Road, I-10, US 90, and US 11, which caused a short-term reduction in LOS on these roads, resulting in adverse short-term impacts. US 90 and US 11 were used heavily and experienced large traffic volume increases during the project construction. A temporary 3-lane-wide bridge was constructed to maintain traffic flow during the I-10 ramp construction for LPV-

109. The construction of the projects described by IER #7 is estimated to have required 20,537,000 total local truck miles, 457,810 total non-local truck miles, and 14,960 total barge miles (USACE 2009r ; appendix F). However, no barges were used for hauling construction material; therefore, truck miles for construction were likely higher than originally estimated.

Impacts for the projects described by IER Supplemental #7 were similar to those described in IER #7; however, lane shifting and minor short-term lane closures on I-10 caused increased traffic congestion, although six lanes of traffic were in use throughout much of the construction period. The short-term lane closures were to be suspended if hurricane evacuation had been necessary. The closure of US 11 required the use of alternate routes, further increasing traffic congestion in the project area. The use of barge offload sites along LPV-111 for clay material delivery reduced the number of trucks delivering this material on the local roads, which potentially led to adverse short-term impacts on traffic congestion.

In projects described by IER #11 (Inner Harbor Navigation Canal Improved Protection) Tier 2 Pontchartrain and IER #11 Tier 2 Borgne, the roadways used to access construction sites for these projects were similar to those described in Orleans East Bank, New Orleans East, and Chalmette Loop sub-basins; however, the majority of transportation for materials was on barges for access to the GIWW and IHNC. The construction of the projects described by IER #11 Tier 1 Pontchartrain and Borgne was estimated to have required 92,070 total barge miles (USACE 2009r; appendix F). There were not many local or non-local truck miles for these two projects; however, France and Jourdon Roads were used to bring in material for work described by IER #11 Tier 2 Pontchartrain.

Specifically, the project's (IER #11 Tier 2) road access to the Michoud Canal staging area were from US 90, Industrial Parkway, and Intracoastal Drive, while road access to the MRGO staging area was from LA 47. The additional truck traffic had no adverse short-term impacts on the LOS for major roadways, but had the potential for major adverse short-term impacts on the LOS and traffic flow for local streets used to access work sites. The increased level of truck traffic within the project vicinity potentially contributed to adverse short-term impacts from delays experienced during hurricane evacuations, since the roads within the vicinity of the project would be used for hurricane evacuation routes. There would be no impact on hurricane evacuation if construction-related traffic is halted during an evacuation.

Roads utilized for the various HSDRRS projects constructed in the sub-basin experienced degradation from additional truck traffic, and the projects had a moderate impact on the transportation infrastructure. Navigation traffic in the IHNC and GIWW experienced temporary channel closure, the use of bypass channels during sector gate construction activities, and narrowing of the channels due to location of barges, dredges, and material in the channels. CEMVN provided navigation bulletins to inform vessel traffic of the changes in channel configuration, when complete closures of navigation channels would occur (such as Bayou Bienvenue and the IHNC), and all construction areas included safety measures such as a Helper Assistant Boat/Contact Vessel stationed in the construction areas.

Chalmette Loop Sub-basin

Construction of components described by IER #8 (Bayous Bienvenue and Dupre Control Structures) caused short-term adverse impacts on local waterborne transportation and operation of local highways and moderate long-term impacts due to infrastructure degradation. Most of the traffic associated with the projects was waterborne, due to the limited road access to the project sites. Barges accessed the project area via the Violet Canal, and light loads were potentially brought through Lake Borgne. The construction of the components was estimated to have required 43,600 total local truck miles, 12,210 total non-local truck miles, and 3,150 total barge miles (USACE 2009r; appendix F). Most of the material used for construction for projects

described by IER #8 was trucked to the construction site. However, the contractor used barges to transport piles, the sector gate leafs, a barge-mounted crane, an excavator, and a hopper barge for excavated material from the channel.

Adverse short-term impacts on traffic in local waterways and on roads within the vicinity of the project area described by IER #9 (Caernarron Floodwall) due to waterborne transportation and worker/truck transportation occurred during construction. The construction of the projects described was estimated to have required 205,300 total local truck miles, 9,840 total non-local truck miles, and 1,420 total barge miles (USACE 2009r; appendix F). During construction, barges were only used to transport the materials for the Highway 39 floodgate, the railroad floodgate, the LPV 149 sector gate, and for piles for LPV 149 (four barge trips for delivery of piles). Most truck traffic was expected to use LA 39. No adverse short-term impacts on the LOS for LA 39 were expected, but moderate impacts due to infrastructure degradation occurred. Smaller access roads potentially had substantial adverse short-term impacts on their LOS.

Truck traffic for the HSDRRS components described by IER #10 (Chalmette Loop Levee) accessed the project sites by I-10, I-510, LA 47, LA 46, and LA 39. The construction of the components was estimated to have required 7,188,300 total local truck miles, 29,080 total non-local truck miles, and 145,220 total barge miles (USACE 2009r; appendix F). The major roadways had little change in their LOS, and experienced moderate infrastructure degradation, but the access roads potentially had substantial changes in their LOS, resulting in adverse short-term impacts.

The Spoil Area borrow site analyzed in IER #31 is located in St. Bernard Parish and has no existing public access road. There is also no highway access to the HSDRRS Spoil Area borrow site. As discussed in IER #31, borrow material would be transported from the site by barge. To complete excavation of the Spoil Area contractor-furnished borrow site, approximately 906,250 truckloads would have been required. Adverse short-term impacts on highway transportation from the barge unloading site to the point of borrow use would likely be minor to moderate during the construction period. However, as of July 2011, the Spoil Area borrow site was not utilized by the HSDRRS construction.

Belle Chasse Sub-basin

Components described in IER #13 (Hero Canal Levee and Eastern Terminus) HSDRRS involved truck access to the project sites primarily by US 90, LA 23, and Walker Road. The construction of IER #13 components was estimated to have required 2,728,900 total local truck miles, 272,120 total non-local truck miles, and 580 total barge miles (USACE 2009r; appendix F). There were adverse minor short-term impacts from an increase in the number of vehicles using LA 23 and Walker Road. The floodgate at LA 23 does not impede traffic on LA 23, except when the gate is closed during a storm event. When the gate is closed during storm events, vehicles will use the emergency bypass. The major roadways had little change in their LOS, but the access roads potentially had substantial changes in their LOS, resulting in minor short-term impacts. Long-term moderate impacts on transportation occurred due to infrastructure degradation from increased truck traffic.

During construction, rail usage had adverse short-term impacts. Additionally, navigation within Hero Canal was restricted to vessels that could pass through the 56 ft wide gate. During construction, the stoplog closure was built in phases, allowing continuous passage of vessels in the canal.

Gretna-Algiers Sub-basin

Truck traffic accessed the project sites described in IER #12 (Harvey and Algiers Canal Levee and Floodwalls) primarily by US 90, Lapalco Boulevard, and LA 23. Barge access was likely through the GIWW. The construction of the components was estimated to have required 2,047,600 total local truck miles, 74,890 total non-local truck miles, and 127,150 total barge miles (USACE 2009r; appendix F), and had a moderate long-term impact due to infrastructure degradation. The LOS for the major highways did not change, but smaller access roads potentially had substantial changes in their LOS, resulting in adverse short-term impacts.

Harvey-Westwego Sub-basin

Truck traffic for the HSDRRS components described in IER #14 (Harvey to Westwego Levee) and IER Supplemental #14.a accessed the project sites primarily by US 90, Lapalco Boulevard, LA 45, and LA 3134. LA 3134 was raised between the WBV-14d floodwall and the WBV-14e levee. This likely caused moderate short-term impacts and transportation delays in the vicinity of the project site. The construction of the projects described by IER #14 was estimated to have required 4,599,700 total local truck miles, 474,140 total non-local truck miles, and 2,570 total barge miles (USACE 2009r; appendix F), causing moderate long-term impacts from infrastructure degradation. Impacts for the projects described by IER Supplemental #14.a were similar to those in IER #14, but were slightly increased because the duration of the construction was longer than was originally anticipated.

Lake Cataouatche Sub-basin

Truck traffic for the projects described in IER #15 (Lake Cataouatche Levee) accessed the project sites primarily by US 90. The construction of the components was estimated to have required 2,049,300 total local truck miles and 228,240 total non-local truck miles (USACE 2009r; appendix F), which caused moderate long-term impacts on transportation due to degradation of roads, and bridges. The LOS for US 90 did not change, but smaller access roads had potential substantial changes in their LOS. It should be noted, however, that without a detailed transportation routing plan, a more detailed impact evaluation of the LOS for minor highways and access roads during construction of the components cannot be done at this time. There was no barge use for the project.

Truck traffic accessed the project sites described in IER #16 (Western Terminus Levee) and IER Supplemental #16.a primarily by US 90, River Road, and South Kenner Road. The construction of the components was estimated to have required 13,207,100 total local truck miles, 488,410 total non-local truck miles, and 2,890 total barge miles (USACE 2009r; appendix F), causing infrastructure degradation. Traffic was maintained during levee construction by the construction and use of a temporary bypass roadway, which included a two-lane shift to the north within the existing US 90 ROW. The LOS for the major highways did not change, but smaller access roads potentially had substantial changes in their LOS, resulting in adverse short-term impacts.

Truck traffic for projects described by IER #17 (Company Canal Floodwall) accessed the project sites primarily by US 90 and Lapalco Boulevard. The LOS for the major highways did not change, but smaller access roads potentially had substantial changes in their LOS, resulting in adverse short-term impacts. Waterborne access was through the Company Canal and the Harvey Canal. Minor impacts on waterborne transportation systems occurred when construction activities were conducted on a marine plant or temporary work platform located over water. To reduce the impacts on waterborne transportation, water-based construction activities were phased or sequenced, where practicable. The construction of the projects described by IER #17 was estimated to have required 596,200 total local truck miles, 2,025,670 total non-local truck miles, and 2,320 total barge miles (USACE 2009r; appendix F).

The River Birch Phase Landfill Expansion borrow site was discussed in IER #31 and is located on US 90 within the Lake Cataouatche sub-basin. Trucks utilizing the HSDRRS borrow area likely used Live Oak Boulevard. Access to the site was not provided from any residential streets. To complete excavation of the River Birch Landfill Expansion contractor-furnished borrow area, it was estimated that it would take approximately 408,000 truckloads. Short-term, congestion-related impacts on US 90 and Live Oak Boulevard in the vicinity of the proposed River Birch Landfill Expansion borrow area were likely moderate to major. Similarly, congestion impacts and decreases in LOS around the excavation area were likely moderate to major during the construction period. The River Birch Landfill Expansion borrow area was utilized by the HSDRRS construction.

Pull-offs/U-turns for the borrow trucks were constructed by the USACE along US 90 on both the eastbound and westbound side of the roadway in an effort to decrease the number of trucks stopped on the roadway.

Borrow Sites by Parish (Borrow IERs #18 through #26, #28 through #32)

As many of the IER borrow sites are located outside of the HSDRRS nine sub-basin project areas, this section will discuss the HSDRRS borrow impacts by parish rather than by sub-basin. All roadways utilized for transportation of borrow material experience infrastructure degradation due to increased truck traffic; infrastructure degradation (i.e., roads and bridges) is a moderate long-term impact on transportation.

St. Charles Parish

US 61 is the major transportation corridor across the Bonnet Carré North area borrow site as analyzed in IER #18. US 61 was used heavily and experienced large traffic volume increases during the project construction. River Road and CC Road were also utilized for accessing the sites from the east and west. The Bonnet Carré North area, if utilized with proper pit management, had minor adverse short-term effects on transportation due to the large expanse of land and road accessibility to the individual pits. The Bonnet Carré North area was utilized for the HSDRRS construction.

IERs #23 and #32 discussed and analyzed the 3C Riverside (Sites 1 and 2) and the Phase 3 site, which were utilized for HSDRRS construction. Sites 1 and 2 borrow areas are located in a rural area on LA 3127. The 118-acre Site 1 is located across from the intersection of LA 3127 and LA 3141. The 146-acre Site 2 (3C Riverside) is located north of the intersection at LA 3127 and LA 3141. Much of the material from these sites could be loaded onto barges for transport. The limited truck hauling had adverse short-term impacts on vehicle traffic and resulted in a minor reduction of LOS on the local roads. As discussed in IER #32, the 3C Riverside Phase 3 site is located between LA 3127 and LA 18. Roads near the site that were also likely used by trucks accessing the borrow area were LA 3141, LA 3127, I-310, the Hale Boggs Bridge, and I-10. The site was not accessed from residential streets. To complete excavation of the 3C Riverside Phase 3 borrow area, it was estimated that it would take approximately 527,000 truckloads. There were likely adverse short-term, congestion-related impacts on those roads in the vicinity of the borrow area. Congestion impacts and decreases in LOS around the excavation area were likely moderate to major during the construction period.

Jefferson Parish

Borrow sites analyzed in IERs #18, #19, #22, #25, #26, and #28 are located in Jefferson Parish and are near I-10, US 90, LA 18, River Road, and South Kenner Road. US 90 was used heavily and experienced large traffic volume increases during the project construction.

The Churchill Farms Pit A, which was used for HSDRRS construction, and Westbank Site G are located close to US 90, which is a heavily used commercial road on the west bank of the

Mississippi River in Jefferson Parish. The area in the project vicinity is mostly industrial, so additional truck traffic likely had no impact on LOS.

The Eastover area borrow site is located just south of I-10 and west of Paris Road and was used for HSDRRS construction. The borrow pit areas are located near industrial refineries, and the additional truck traffic had no impact on area roadways since it likely blended in with the local commercial traffic.

The Westbank F area is located in an urban area near US 90 and is adjacent to an unnamed shell road on the east. US 90 is a heavily used commercial road on the west bank. Westbank Site I is located on the north side of LA 18, which is a heavily used commercial road on the west bank. Truck hauling would temporarily impede vehicle traffic and result in a minor reduction of LOS on the local roads. As of July 2011, the Westbank F area borrow site was not used for the HSDRRS construction.

The Westbank D proposed borrow area is located on US 90 just west of Live Oak Lane, and has not been used for borrow material for HSDRRS construction. The Westbank E Phase 1 and Phase 2 borrow areas, also described in IER #25, are located on the east side of Live Oak Lane. These borrow areas are likely to be used for construction sites within the area. Truck hauling would temporarily impede vehicle traffic and result in a negligible reduction of LOS on the local roads.

The South Kenner Road borrow area is located on South Kenner Road. The Willswood borrow area is located on the south side of River Road. Both have been utilized for construction. These road segments do not receive heavy traffic loads. The borrow from these areas would be used for construction sites within the area. Truck hauling temporarily impeded vehicle traffic and resulted in a reduction of LOS on the local roads.

As detailed in IER #28, the Westbank F access area is located on US 90 and is adjacent to an unnamed shell road on the east. Trucks entering or exiting the Westbank F borrow site would use the dirt road that leads to the unnamed shell road. Major roads in the vicinity include US 90, Lapalco Boulevard, and LA 18 (River Road). To complete excavation of the HSDRRS borrow area, it is estimated that it would take approximately 11,000 truckloads. Congestion impacts and decreases in LOS around the excavation area would likely be moderate to major during the construction period. As of July 2011, the Westbank F borrow site was not used for the HSDRRS construction.

Orleans Parish

Over 30 HSDRRS borrow sites are described in IERs #18, #19, #25, and #29. Of those, six were located in Orleans Parish and would utilize roads throughout the parish for transportation of borrow material to the HSDRRS project component project areas.

The Maynard borrow area, which was used for construction, and the Cummings North site are analyzed in IER #18. The Maynard area fronts a service road that connects Almonaster Avenue with the Chef Menteur Highway. The Cummings North area fronts Michoud Boulevard on the west. Michoud Boulevard bisects Lake Forest Boulevard that leads to I-510. The area in the project vicinity involves mostly commercial trucking, so additional truck traffic was not likely to impact area roadways or traffic.

The River Birch Phase 1 and River Birch Phase 2 sites are located in rural areas, were utilized for HSDRRS construction, and had four access points from a shell entrance road that leads to LA 90. The area is commercial in nature and truck haulers blended in with the local commercial traffic.

The Stumpf Phase 1 and Stumpf Phase 2 borrow areas are located on Industrial Parkway. Industrial Parkway intersects Chef Menteur Highway, which has a high volume of commercial traffic. The GIWW would be used to transport borrow material to and from construction sites by barge. The use of this area would temporarily increase waterway traffic in the GIWW. Truck hauling would temporarily impede vehicle traffic and result in a minor reduction of LOS on the local roads. As of July 2011, the Stumpf Phase 1 and 2 borrow sites were not used for the HSDRRS construction.

The Eastover Phase II borrow area is located on East Point Court, which also serves as the I-10 East service road, and was used for construction. Roads near the site that were likely used by trucks accessing the borrow area are I-510 and Lake Forest Boulevard. To complete excavation of the HSDRRS borrow area, it was estimated that it would take approximately 336,000 truckloads. Congestion impacts and decreases in LOS on the I-10 and I-510 service roads, Lake Forest Boulevard, and Chef Menteur Highway were likely moderate to severe during the construction period.

St. Bernard Parish

Thirteen HSDRRS borrow sites described in IERs #18, #19, #23, #28, #30, and #31 are located in St. Bernard Parish. The majority of these sites can be accessed by traveling on either LA 39 or LA 46.

Borrow sites are located off of Bayou Road and Florissant Highway, which are two-lane streets that intersect LA 39. Bayou Road and Florissant Highway do not receive heavy traffic loads; therefore, adverse short-term impacts on transportation would be negligible. If the borrow areas are used, material would likely be used for levees closest to a particular borrow site, minimizing the disruption of transportation through the developed areas. While efforts to restore existing developments in the parish are ongoing, the reduced population has also led to the reduced residential traffic congestion.

Three borrow sites within St. Bernard Parish include the Sylvia Guillot, the Gatién-Navy Camp Hope, and the DK Aggregates areas. The Sylvia Guillot borrow area is located on the south side of Bayou Road, while the Gatién-Navy Camp Hope site is east of St. Bernard Highway. The DK Aggregates site is located on the south side of LA 46. The 1025 Florissant Highway borrow area is located on Florissant Highway and the Acosta borrow area is located on the north side of LA 46. These five borrow pit sites are all located on road segments that do not receive heavy traffic loads; thus, the adverse short-term impacts should be minor. As of July 2011, none of these five borrow sites were utilized by the HSDRRS construction.

The Johnson/Crovetto borrow area is located off of Bayou Road (old LA 46). The site is accessible from a dirt road that ties directly into Bayou Road. Major roads in the vicinity include LA 39 and LA 3137. To complete excavation of the HSDRRS borrow area, it is estimated that it would take approximately 17,000 truckloads. Adverse short-term impacts from congestion and decreases in LOS on Bayou Road and around the excavation area would likely be moderate during the construction period. As of July 2011, the Johnson/Crovetto borrow site was not utilized by the HSDRRS construction.

The Contreras borrow area was used for HSDRRS construction and is located off of Bayou Road, which can be accessed by LA 46. The site was accessed through the use of Bayou Road, which has one lane in either direction and is not in very good condition. To complete excavation of the borrow area, it was estimated that it would take approximately 548,000 truckloads. Congestion impacts and decreases in LOS on the areas around the site were likely moderate during the construction period.

The Acosta 2 borrow site is located on LA 46, and the site was accessed from LA 46. Roads near the site that were also likely used by trucks utilizing the borrow area included LA 39, LA 47, I-510, and I-10. Access to the site was not provided from any residential streets. To complete excavation of the Acosta 2 contractor-furnished borrow area, it was estimated that it would take approximately 19,000 truckloads. Adverse, short-term, congestion-related impacts on LA 46, LA 39, LA 300, Paris Road, I-510, and I-10 in the vicinity of the Acosta 2 borrow area were likely moderate. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area were likely moderate to major during the construction period. The Acosta 2 borrow site was utilized for the HSDRRS construction.

Plaquemines Parish

IERs #18, #19, #22, #23, #25, #26, #28, #31, and #32 described the HSDRRS borrow sites located in Plaquemines Parish. The main highways located in Plaquemines Parish are LA 23 on the west bank and LA 39 on the east bank of the Mississippi River.

The Belle Chasse borrow area is on the Belle Chasse NAS property just south of Rinard Road, a two-way street that leads into Russel Drive, which intersects LA 23. The area is only 8 acres in size, so truck hauling would be short in duration. Adverse short-term impacts on transportation would be minor. As of July 2011, the Belle Chasse borrow site was not utilized by the HSDRRS construction.

The Kimble #2 area site is located in Phoenix, between LA 39 and LA 15, just south of LA 39 and west of Thomas Lane. The area is only 10.4 acres in size, so truck hauling would be of short duration. Adverse short-term impacts on transportation would be minor. As of July 2011, the Kimble #2 borrow site was not utilized by the HSDRRS construction.

The Brad Buras borrow site is located on LA 23, which is used daily by large trucks hauling freight to and from Venice, LA. The area is only 9 acres in size, so truck hauling would be short in duration from the area. The Tabony area is located on the east side of the Mississippi River and fronts LA 15 in a rural part of the parish. The Westbank N area is located in a rural area on the south side of Walker Road near LA 23 and was utilized for construction. Truck hauling would cause adverse short-term impacts on vehicle traffic and result in a minor reduction of LOS on the local roads. As of July 2011, the Brad Buras and Tabony borrow sites were not utilized for HSDRRS construction.

The Myrtle Grove borrow area is located in a rural area on West Ravenna Road which intersects with LA 23. The fill from this site would likely be used on HSDRRS construction sites within a 20-minute drive of the borrow area. Adverse short-term impacts on transportation would be minor. As of July 2011, the Myrtle Grove borrow site was not utilized by the HSDRRS construction.

The Tac Carrere borrow area is located in a rural area on LA 23 near Nairn, LA. This borrow area would likely be used on HSDRRS construction sites within the area. Truck hauling would cause adverse short-term impacts on vehicle traffic and result in a minor reduction of LOS on the local roads. As of July 2011, the Tac Carrere borrow site was not utilized by the HSDRRS construction.

The Meyer borrow area is located in a rural area in Braithwaite on the east side of LA 39. This road segment does not receive heavy traffic loads, and little traffic congestion would be expected during the construction period. However, truck hauling would result in adverse short-term impacts, as vehicle traffic would be temporarily impeded, and a minor reduction of LOS on the local roads would also be likely. As of July 2011, the Meyer borrow site was not utilized by the HSDRRS construction.

The Bazile government-furnished borrow area is located between LA 39 and LA 3137. The site can only be accessed through a dirt road leading from Bazile Drive, a residential street with approximately 30 residences located on it. Major roads in the vicinity include LA 46 and LA 39. To complete excavation of the proposed borrow area, it is estimated that it would take approximately 42,000 truckloads. Bazile Road would be used as the access route for construction equipment to and from LA 3137. Adverse short-term impacts from congestion and decreases in LOS on Bazile Road and around the excavation area would likely be moderate to major during the construction period. As of July 2011, the Bazile borrow site was not utilized by the HSDRRS construction.

The Idlewild Stage 2 borrow site was used for HSDRRS and is located on LA 23; construction access to the site was from LA 23 and other farm roads that connect to LA 23. Access to the site was not provided from any residential streets. To complete excavation of the Idlewild Stage 2 borrow area, it was estimated that it would take approximately 225,000 truckloads. Adverse short-term, congestion-related impacts on LA 23 in the vicinity of the Idlewild Stage 2 borrow area were likely moderate to major. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area were likely moderate to major during the HSDRRS construction.

The Scarsdale borrow site is located at LA 39 and Scarsdale Road. LA 46 would also likely be used by trucks using the proposed borrow area. Access to the site would be provided from a residential street, Scarsdale Road. To complete excavation of the proposed Scarsdale borrow area, it is estimated that it would take approximately 208,000 truckloads. Adverse short-term, congestion-related impacts on Scarsdale Road in the vicinity of the proposed borrow area would likely be moderate to major. Due to frequent heavy loads, local roadways around the project area, especially Scarsdale Road, would likely suffer degradation requiring rehabilitation sooner than would normally be expected. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area would likely be moderate during the construction period. As of July 2011, the Scarsdale borrow site was not utilized by the HSDRRS construction.

Most of the HSDRRS borrow sites described in IER #32 were located in Plaquemines Parish, and include the Citrus lands, Conoco Phillips, Idlewild Stage 1, Nairn, and Plaquemines Dirt and Clay sites.

The Citrus Lands site is located on LA 23. Roads near the site also likely to be used by trucks utilizing the borrow area are Lacrosse Lane and other farm roads. Access to the site would not be provided from any residential streets. To complete excavation of the proposed Citrus Lands borrow area, it is estimated that it would take approximately 735,000 truckloads. As of July 2011, the Citrus Lands site was not utilized by the HSDRRS construction.

The Conoco Phillips borrow site is located on LA 23. Roads near the site that would also likely be used by trucks using the borrow area are West Ravenna Road, Windmill Road, and other farm roads. Access to the site would not be provided from any residential streets. To complete excavation of the proposed Conoco Phillips area, it is estimated that it would take approximately 1.1 million truckloads. As of July 2011, the Conoco Phillips borrow site was not utilized by the HSDRRS construction.

The Idlewild Stage 1 site is located on LA 23 and was used for construction. Access to the site was not provided from any residential streets. To complete excavation of the Idlewild borrow area, it was estimated to take approximately 270,000 truckloads.

The Nairn site is located on LA 23. Roads near the site that would also likely be used by trucks using the proposed borrow area are Shirley B Lane and other farm roads. Access to the site

would not be provided from any residential streets. To complete excavation of the proposed Nairn borrow, it is estimated that it would take approximately 42,000 truckloads. As of July 2011, the Nairn borrow site was not utilized by the HSDRRS construction.

The Plaquemines Dirt and Clay borrow site is located on LA 23. Roads near the site that were also likely used by trucks using the borrow area are Lacrosse Lane and other farm roads. Access to the site was not provided from any residential streets. To complete excavation of the Plaquemines Dirt and Clay borrow area, it was estimated that it would take approximately 435,000 truckloads. The Plaquemines Dirt and Clay site was utilized for the HSDRRS construction.

There were likely adverse short-term, congestion-related impacts on those roads in the vicinity of each of the borrow areas utilized as of July 2011. Congestion impacts and decreases in LOS around the excavation areas were likely moderate during the construction period.

Ascension Parish

The Bocage borrow site is located on LA 942. Roads near the site also likely to be used by trucks utilizing the proposed Bocage borrow area are LA 44, LA 22, and I-10. Access to the site would not be provided from any residential streets. To complete excavation of the HSDRRS Bocage borrow area, it is estimated that it would take approximately 120,000 truckloads. Adverse short-term impacts from congestion and decreases in LOS around the excavation area would likely be moderate during the construction period. As of July 2011, the Bocage borrow site was not utilized by the HSDRRS construction.

East Baton Rouge Parish

The Lilly Bayou borrow site is located on US 61 in East Baton Rouge Parish near the intersection of US 61 and LA 64 and was utilized for construction. There are two access roads near the site that were also likely used by trucks using the Lilly Bayou borrow area, and both are located off US 61. Access to the site was not provided from any residential streets. To complete excavation of the Lilly Bayou borrow area, it was estimated that it would take approximately 910,000 truckloads. Adverse short-term, congestion-related impacts on Salvant Road and US 61 were likely major. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area were likely major during the construction period.

Iberville Parish

The St. Gabriel Redevelopment site is located in a rural area near Carville east of LA 75. The borrow pit areas are located near industrial refineries, and the additional truck traffic would have no impact since it would blend in with the local commercial traffic. As of July 2011, the St. Gabriel Redevelopment borrow site was not utilized by the HSDRRS construction.

Lafourche Parish

The Raceland Raw Sugars site is located on US 90 and LA 308. Roads near the site that would also likely be used by trucks utilizing the proposed Raceland Raw Sugars borrow area include LA 182 and other farm roads connecting to LA 308 and LA 182. Access to the site would not be provided from any residential streets. To complete excavation of the proposed Raceland Raw Sugars borrow area, it is estimated that it would take approximately 481,000 truckloads. Adverse short-term, congestion-related impacts on LA 308 and US 90 in the vicinity of the proposed borrow area would likely be moderate. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area would likely be moderate during the HSDRRS construction period. As of July 2011, the Raceland Raw Sugars site was not utilized by the HSDRRS construction.

St. James Parish

The Big Shake borrow area is located between West Jefferson Highway (LA 44) and LA 3125 on Hester Street. The site is accessible from I-10 and US 61 through the use of LA 3125. In order to access LA 44, vehicles must use a very narrow road and cross a set of raised railroad tracks. To complete excavation of the proposed borrow area, it is estimated that it would take approximately 920,000 truckloads. Adverse short-term impacts from congestion and decreases in LOS on the areas around the site would likely be major during the construction period. As of July 2011, the Big Shake borrow site was not utilized by the HSDRRS construction.

St. John the Baptist Parish

The Willow Bend borrow areas are located in a rural area on the south side of River Road and were used for HSDRRS construction. These borrow areas are not located near any HSDRRS construction sites and fill was hauled out of the parish to the project sites. Truck hauling caused adverse short-term impacts on vehicle traffic and resulted in a reduction of LOS on the local roads. Major roads in the vicinity include LA 3127, LA 639, West 4th Street, and Goldmine Plantation Road. To complete excavation of the borrow area, it was estimated to take approximately 1 million truckloads. The Willow Bend Phase 2 site is about 10 times the size of the Willow Bend I site. Congestion impacts and decreases in LOS on the areas around the site were likely major during the construction period.

St. Tammany Parish

The Tammany Holding borrow area site is located off of I-10 near Oak Harbor Boulevard and was used for construction. The site is accessible using Oak Harbor Boulevard to Harbor Center Boulevard and Lakeshore Boulevard North, Howze Beach Road, or LA 433. To complete excavation of the borrow area, it was estimated that it would take approximately 840,000 truckloads. Adverse short-term impacts due to congestion and decreases in LOS for the areas around the site were likely moderate to major during the construction period.

The Levis borrow site is located just off of US 190. Another road near the site that would also likely be used by trucks using the proposed borrow area is Daney Street. Access to the site would be from US 190 via streets serving the new development, and would not be provided from any residential streets. To complete excavation of the proposed Levis borrow area, it is estimated that it would take approximately 106,000 truckloads. Adverse short-term, congestion-related LOS impacts on Daney Street, US 190, and I-10 in the vicinity of the proposed Levis borrow area would likely be moderate. The Levis borrow site was not utilized for the HSDRRS construction as of July 2011.

Hancock County, Mississippi

Six borrow sites in Hancock County were described in IERs #19, #23, #26, #30, and #31. The Pearlinton Dirt Phase I and Phase II sites, which are located in a rural area and front Whites Road, lead into US 90 to the east and US 604 to the west. The logging industry is a major contributor of jobs in the area and truck haulers blended in with the local commercial truckers. Truck hauling caused adverse short-term impacts on vehicle traffic and resulted in a minor reduction of LOS on the local roads. The Pearlinton Dirt Phase I and Phase II were utilized for the HSDRRS construction.

The Frierson borrow area is located in a rural area south of Lower Bay Road. Truck hauling would cause adverse short-term impacts on vehicle traffic, and result in a minor reduction of LOS on the local roads, but not much congestion would be expected. The Frierson borrow area was not utilized for the HSDRRS construction, as of July 2011.

The Henley proposed borrow area is located on Kiln-Picayune Road, alternatively referred to as Old Picayune Highway. This area is accessed via I-10 by Mississippi State Highway (MS) 43/603 (Kiln-Picayune Road), which is a narrow, one-lane road that has not been well

maintained. Alternatively, trucks can access the borrow area by MS 43 where it splits from MS 603, and use the Firetower Road to access the area. Both routes consist of extremely narrow roadways with residential development nearby. To complete excavation of the proposed borrow area, it is estimated that it would take approximately 410,000 truckloads. Adverse short-term impacts from congestion and decreases in LOS on the areas around the site would likely be moderate during the construction period. As of July 2011, the Henley borrow site was not utilized by the HSDRRS construction.

The King Mine borrow site is located on US 90. Roads near the site that would also likely be used by trucks for HSDRRS construction are MS 607, MS 43, MS 603, US 190, and I-10. Access to the site would not be provided from any residential streets. To complete excavation of the proposed King Mine borrow area, it is estimated that it would take approximately 288,000 truckloads. Adverse short-term, congestion-related impacts on US 90, MS 607, MS 43, MS 603, US 190, and I-10 in the vicinity of the proposed King Mine borrow area would likely be moderate. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area would likely be moderate during the construction period. As of July 2011, the King Mine borrow site was not utilized by the HSDRRS construction.

The Port Bienville borrow site is located on US 90 and borrow material was used for construction. Roads near the site also likely used by trucks for the HSDRRS construction area are Lower Bay Road, MS 607, MS 43, MS 603, US 190, and I-10. There are three access roads to the site, one from US 90 and two from Lower Bay Road. No residential streets provided access to the site. To complete excavation of the Port Bienville borrow area, it was estimated that it would take approximately 1,410,000 truckloads. Adverse short-term, congestion-related impacts on Lower Bay Road, US 90, US 190, and I-10 in the vicinity of the Port Bienville borrow area were likely major. Similarly, adverse short-term impacts from congestion and decreases in LOS around the excavation area were likely major during the construction period.

4.2.14.2.2 HSDRRS 2057 Impacts

Short-term, temporary construction-related transportation impacts due to future levee lifts would be similar to the HSDRRS construction impacts. These would include minor to major reduction in LOS on some local road segments including access roads, and minor reduction in LOS on major roadways that could result in adverse short-term impacts. Adverse short-term impacts include road closures and congestion in those areas where construction would occur. After construction is complete, the HSDRRS would have minor long-term impacts on transportation from infrastructure degradation.

Similar to the use of the borrow areas for completed and ongoing construction, there would be impacts on the roads that are used near borrow areas used for future levee lifts. Adverse short-term, congestion-related impacts and degradation of the roads in the vicinity of the proposed 2057 borrow areas would likely be moderate to major during the construction period. Impacts on transportation would occur as a result of the additional demand for borrow, but until borrow sites are selected, the total impacts cannot be estimated.

4.2.14.3 Cumulative Impacts

4.2.14.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

The HSDRRS construction and associated excavation of borrow areas contributed directly and indirectly to cumulative impacts on the transportation system throughout the project area. Cumulative moderate adverse impacts such as damage and degradation of infrastructure and roadway wear-and-tear due to increased truck traffic occurred within the project area. Likewise, lower flood risk to the Greater New Orleans Metropolitan Area upon completion of the HSDRRS is expected to cause additional economic and population growth in the region and thus increase

the demand for transportation resources, which could lead to cumulative indirect long-term adverse impacts. Indirectly, traffic congestion caused by truck traffic on some roadways likely altered traffic patterns of commuters and residents, increasing traffic congestion on roads not directly used for HSDRRS-related transportation.

The majority of HSDRRS impacts on transportation LOS are short-term, and will end when construction is completed. Future levee lifts would continue to have temporary road impacts, but over the 50-year life of the project, these would be sporadic and widespread. Long-term cumulative impacts on transportation from the HSDRRS would occur from damage to roadways from truck traffic.

Construction of the HSDRRS would also provide beneficial impacts on transportation resources in the region, as it reduces flood risk and future storm damage to these resources. The HSDRRS construction has the long-term potential to save millions of dollars in repair costs for highways, roads, bridges, railroads, airports, and public transit systems (streetcar lines) that could otherwise be damaged by future flooding.

4.2.14.3.2 Cumulative Impacts of other Present and Future Regional Actions

Present and future actions by the USACE and other agencies for project construction and maintenance would likely further contribute to cumulative degradation of roadway pavement and traffic congestion, since many projects require the use of heavy trucks and construction equipment.

Storm Damage Reconstruction

The South Louisiana Submerged Roads Program is addressing more than 50 street repair projects in Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany parishes, and can be seen in figure 4-11. The program will repair and resurface roads damaged as a result of Hurricane Katrina. In addition to being under water for a significant period of time, many of these roads were heavily used by repair crews with heavy equipment and trucks in the wake of Hurricane Katrina, which caused significant damage to the roads. Major and minor renovations to various municipal buildings, parks, community centers, etc., are also ongoing. The impacts of these projects on transportation would include increased traffic, congestion, and roadway degradation on the roadways near each of the repair projects.

Transportation

There are several ongoing and proposed transportation-related projects in the vicinity of the HSDRRS. Two transportation-related projects within the Jefferson East Bank sub-basin include the Earhart-Causeway Interchange and the Huey P. Long Bridge Widening in Jefferson Parish. Transportation-related projects within the New Orleans East sub-basin include the replacement of the Florida Bridge over IHNC in Orleans and St. Bernard parishes, repair of the I-10 Bridge over Lake Pontchartrain, the replacement of the IHNC Lock and associated modification to the St. Claude Avenue and North Claiborne Avenue bridges, and the Causeway/I-10 Interchange projects. Construction of I-49 south from Raceland to the Westbank would take place within the Lake Cataouatche sub-basin. These projects would increase construction-related traffic in the area in the short term, but would be beneficial in decreasing traffic congestion when completed. Moderate to major impacts on transportation would occur as a result of these projects within the next 3 to 5 years.

Flood Risk Reduction Projects

Construction of other flood control projects, including floodwalls, floodgates, and levees throughout the area, is currently under way or being planned for the near future. Many of these projects would require transport of material (borrow, sheet metal, h-piles, etc.) by heavy trucks.

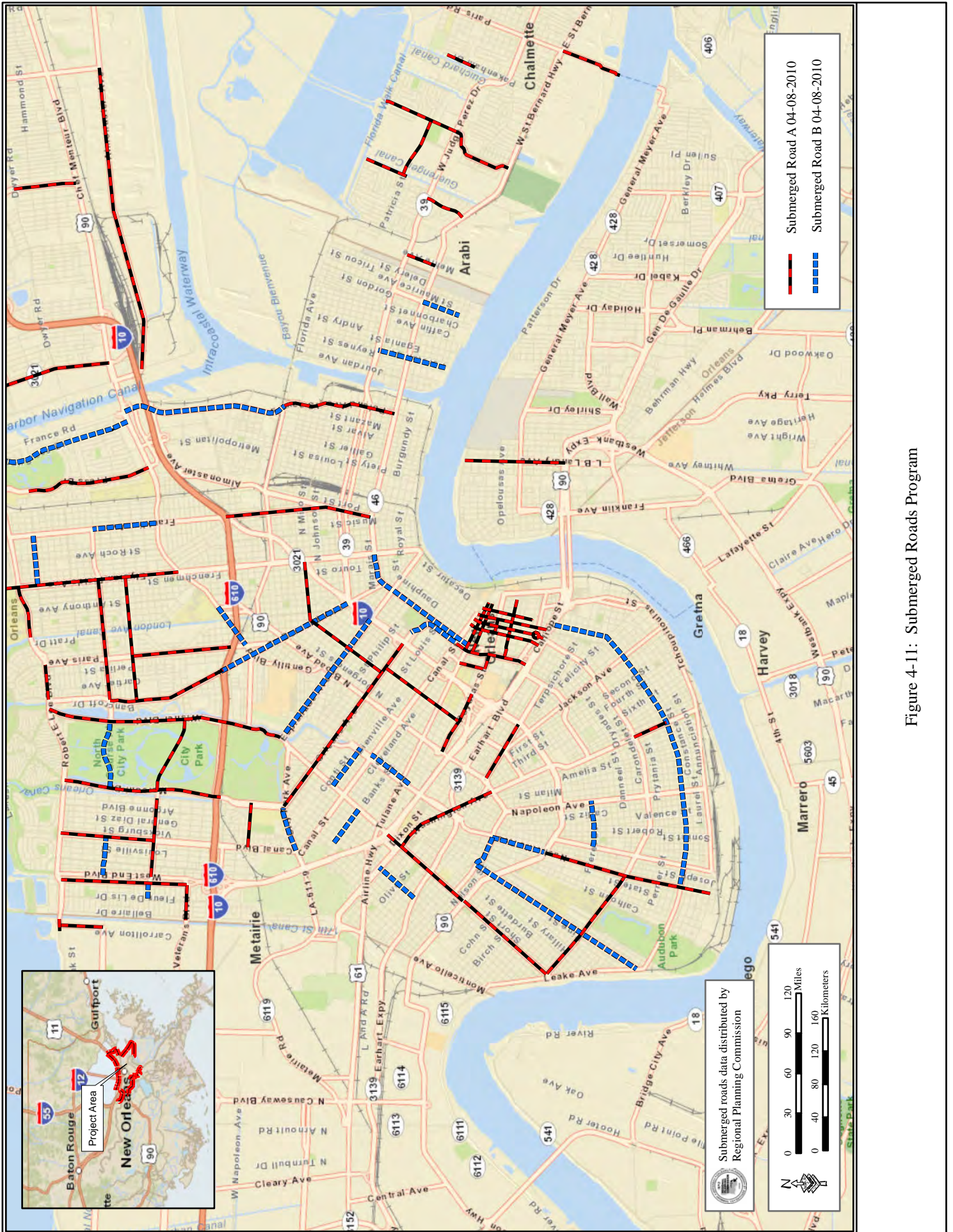


Figure 4-11: Submerged Roads Program

Other flood risk reduction projects are located throughout the project area, including Orleans, Plaquemines, St. Bernard, Jefferson, and St. Charles parishes. Projects such as New Orleans to Venice Federal and non-Federal Levees, Morganza to the Gulf, Larose to Golden Meadow, and Grand Isle and Vicinity would involve increased traffic congestion and additional roadway degradation through the HSDRRS project area, since some of the major roadways would potentially be used by construction equipment and heavy trucks for material transport. Flood risk reduction projects would require a substantial increase in heavy truck use for borrow requirements; thereby yielding roadway impacts similar to those of the HSDRRS. Moderate to major impacts on transportation would occur as a result of these projects within the next 3 to 5 years.

4.2.14.3.3 Summary of All Cumulative Impacts for Transportation

The combination of the HSDRRS construction, excavation of borrow areas, and other regional projects (e.g., transportation, storm damage reconstruction, coastal and wetlands restoration and flood risk reduction projects) would contribute directly and indirectly to cumulative impacts on transportation in the project area. Cumulative moderate adverse impacts such as increased traffic, damage and degradation of infrastructure and roadway wear and tear due to increased truck traffic, in conjunction with concurrent regional construction projects, would be expected within the HSDRRS project area. Likewise, lower flood risk to the Greater New Orleans Metropolitan Area upon completion of the HSDRRS would cause additional economic and population growth in the region and thus would increase the demand for transportation resources, which could lead to cumulative indirect long-term adverse impacts. However, there would also be long-term beneficial impacts on transportation resources from the HSDRRS construction due to the potential to save millions of dollars in repair costs for transportation infrastructure that could otherwise be damaged by flooding.

4.2.15 Socioeconomic Resources and Environmental Justice

4.2.15.1 Affected Environment

EO 12898 (Federal Actions to Address Environmental Justice in Minority and Low-Income Populations) requires Federal agencies to make achieving environmental justice part of their respective missions by identifying and addressing, as appropriate, disproportionate high and adverse human health or environmental effects of their program policies and activities on minority and low income populations. The USACE and most Federal agencies determine impacts on low-income and minority communities as part of the NEPA compliance process. Additionally, the DoD Strategy on Environmental Justice (March 24, 1995) provides a method to address Environmental Justice. Minority populations are those persons who identify themselves as Black (African American), Hispanic, Asian American, American Indian/Alaskan Native, and Pacific Islander. Low-income populations as of 2010 are those in which income is \$22,314.00 for a family of four; low income is defined using the U.S. Census Bureau's (USCB) statistical poverty threshold. An evaluation of Environmental Justice will identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of the project on minority and low-income populations. The methodology to accomplish this includes identifying low-income and minority populations within the project area, as well as community outreach activities such as Environmental Justice stakeholder meetings.

This section provides an overview of social patterns and neighborhoods located within the HSDRRS area and the analysis performed to address HSDRRS's potential to affect demographic patterns and other social and economic characteristics within the area. Additionally, within this section is an overview of the variables that are indicators of low-income and minority populations.

The HSDRRS impact area includes businesses, employment, and income opportunities in St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard parishes.

Historic Setting for the HSDRRS Five-Parish Project Area **St. Charles Parish**

In the late 1700s, tobacco and indigo were the crops of choice in St. Charles Parish, and plantation homes began to spring up along the Mississippi River. In the early 1900s, as the River Road plantations were sold and the area began to change, St. Charles went from an economy based on agriculture to one based on industry. In the early 1920s, oil refineries and related industries began locating in St. Charles Parish. In the 1950s, as the old plantations were no longer farmed they continued their gradual disappearance, yet their names lived on in the location of the sites of many of the incoming industries. Those industries were primarily petrochemical-related industries such as Monsanto and Lion Oil Company, Shell Chemical, Union Carbide, Hooker Chemical (Occidental Chemical), and the Bunge and St. Charles Grain elevators (St. Charles Parish 2010).

As one of Louisiana's fastest growing parishes, St. Charles Parish has grown from a traditionally rural area into one of the New Orleans metro area's more prosperous regions. The parish's primary economic engines, which include Dow Chemical, Valero, Port of South Louisiana, Cytec, Shell/Motiva, and First American Bank, offer higher than average wages and have successfully attracted many new families to the local area. However, this does not mean that all residents within the parish earn a living wage or can afford basic services, such as health care or private transportation (St. Charles Parish 2010).

At the northwestern end of the St. Charles Parish HSDRRS alignment, there are two major industrial complexes, which include Motiva Enterprises and Resolution Resins facilities. These entities surround the community of Norco, Louisiana. South and east of Norco are the communities of New Sarpy and Destrehan. Both New Sarpy and Destrehan occupy lands that reach from the MRL to Airline Highway. New Sarpy has a significant minority population. There is also a large residential and commercial component on the southeastern end of the parish near St. Rose. A large area of open land in the central portion of the parish is sparsely populated. In 2000, the St. Charles Parish population was 48,019 with 86 percent of the population considered to be urban and 14 percent in rural, non-farm areas. According to recently released data from the USCB (2010), St. Charles Parish's population in 2010 was 52,780. This represents an increase of 4,708 residents over the 10-year period. A total of 47 percent of the parish's students were eligible for free and reduced lunch (St. Charles Parish Public School District 2012).

Jefferson Parish

Established in 1825, Jefferson Parish was named in honor of Thomas Jefferson for his role in purchasing the Louisiana territory from France in 1803. Originally, the parish extended from the current-day Felicite Street in New Orleans to the St. Charles Parish line; however, as Orleans Parish grew it annexed the Garden District, Lafayette, Jefferson, and Carrollton from Jefferson Parish. In 1874, the present-day parish boundary was established and the parish government seat was transferred to Gretna on the West Bank, which remains the seat today (Jefferson Parish Louisiana Website 2010). In the past, Jefferson Parish was a rural area of dairy farms with very large tracts of undeveloped land. Jefferson Parish is divided by the Mississippi River into the West Bank and East Bank areas and is predominantly west of the City of New Orleans (Jefferson Parish Louisiana Website 2010). From the 1950s to the 1970s, the parish became a bedroom community as many New Orleans middle-class families moved out of the city (Jefferson Parish Louisiana Website 2010).

Jefferson Parish's largest community is the unincorporated area of Metairie that contains most of East Jefferson. Smaller unincorporated areas include River Ridge and Jefferson. East Jefferson cities include Kenner and Harahan while cities such as Gretna and Westwego are in West

Jefferson (Jefferson Parish Louisiana Website 2010). According to recently released data from the USCB (2010), Jefferson Parish's population in 2010 was 432,552. This represents a decline of 22,914 from the 2000 population count of 455,406.

Prior to the construction of the Huey P. Long Bridge, ferry boats provided the only link between the east and west banks of Jefferson Parish. At the time of the construction of the Huey P. Long Bridge in 1935, there was little use for it, as it was built too far upriver from New Orleans. In 1958, the first span of the Crescent City Connection opened, providing Jefferson Parish residents with bridge access over the Mississippi River to New Orleans, with the second span opening in 1988 (Jefferson Parish Louisiana Website 2010).

Orleans Parish

New Orleans is one of the older urban centers in the U.S., developing from its natural waterways, port facilities and services, commercial fisheries, oil and gas production, ship building, National Aeronautics and Space Administration space programs, and its tourism, entertainment, and convention facilities. Tourism was originally fueled by natural access to the river and was promoted in New Orleans as early as 1884. As the economy and transportation systems of the Greater New Orleans Metropolitan Area grew and expanded, population and housing increased until the 1960s; however, like many large cities, growth shifted to the suburbs by the 1970s.

The entire Greater New Orleans Metropolitan Area, which includes all five parishes in the HSDRRS project area, experienced an oil boom in the 1970s and then an oil bust in the mid-1980s. Total jobs in the New Orleans region hit a low point of 551,850 in 1987 (down from 588,170 in 1980), then increased, even as the U.S. lost jobs during the 1990 to 1991 recession. By 2000, the population of Orleans Parish was approximately 484,692 (USCB 2008). According to recently released data from the USCB (2010), Orleans Parish's population in 2010 was 343,829. This represents a decline of 140,845 residents over the 10-year period. The New Orleans region largely did not participate in the dot-com boom of the late 1990s, but it did fall into recession along with the rest of the Nation in 2001. The New Orleans area rebounded from the 2001 recession at a pace similar to the U.S. Then Hurricane Katrina struck in 2005, causing the loss of 21 percent of the region's jobs (GNOCDC 2010a).

The incorporated city limits of New Orleans are the same as the boundaries of Orleans Parish. Some neighborhoods located on the West Bank and in New Orleans East within Orleans Parish include Algiers, Chef Menteur, Green Ditch, Lake Catherine, Little Woods, Recovery, Rigolets, Stanton, and the Venetian Isles.

St. Bernard

St. Bernard Parish is located approximately 5 miles from downtown New Orleans and has historically been tied to New Orleans. As New Orleans developed and expanded, so did St. Bernard; however, in the 1960s, as New Orleans' inner city population declined, suburban flight brought people to St. Bernard. St. Bernard's culture, lifestyle, and economy have been strongly associated with wildlife, fisheries, and agriculture due to its unique environment. With approximately two-thirds of the parish surrounded by water and with an abundance of marshland, it may be one of the largest and richest wetlands ecosystems in North America (St. Bernard Parish.net 2003).

After the transfer of the Louisiana territory from France to Spain, the Spanish, under Bernardo de Galvez, brought several hundred settlers from the Canary Islands, the Isleneos, who settled in lower St. Bernard Parish. Throughout the late 1700s and into the early 1800s, the area became more densely settled and the rich fertile land was utilized more extensively by farmers who grew crops including sugar cane, indigo, and vegetables.

The character, as well as the population, of St. Bernard Parish changed very little until the 1940s, but by 1950 the population grew to 11,807, a 52 percent increase over the previous census. By 1960, St. Bernard Parish had grown to 32,186, and was the largest percentage population increase in St. Bernard Parish's history (St. Bernard Parish.net 2003). With this increase came an increase in industrial development. Located primarily between the Mississippi River and St. Bernard Highway are St. Bernard Parish's Port area and major refining operations, such as the American Sugar Refinery and Exxon Mobil (St. Bernard Parish.net 2003). The population of St. Bernard Parish in 2000 was 67,230 (GNOCDC 2003). According to recently released data from the USCB (2010), St. Bernard Parish's population in 2010 was 35,897. This represents a decline of 31,332 residents over the 10-year period.

Plaquemines Parish

On March 2, 1699, the French located the mouth of the Mississippi River near what is presently known as Passe a Loutre and established a French colony on the central Gulf Coast. The name, Plaquemines, comes from an Indian word *piakimin*, meaning persimmon, which grew on the banks of the river. Because of its location at the mouth of the river, Plaquemines Parish had a number of military and nautical sites over the years. In the 1700s, a number of forts were built to protect the mouth of the Mississippi by the French and the Spanish and later the U.S. (Lincoln 2010). In 1904, President Theodore Roosevelt established the Nation's second NWR (Lincoln 2010), which became known as the Delta-Breton Wildlife Refuge. The refuge contains 48,800 acres of river estuary plus another 6,923 acres on Breton Island. Naval bases at Burrwood and Port Eads, both at the mouth of the river, and important naval munitions and communications facilities were built at English Turn during World War II. The Belle Chasse airfield was also converted to a military blimp airfield during WWII. Plaquemines Parish was one of the few places in the continental U.S. that the Germans attacked, and their submarines were often observed by local citizens (Lincoln 2010).

On March 31, 1807, Plaquemines Parish was one of 19 parishes created by dividing the Territory of New Orleans. In the early 1700s settlers to the area planted indigo and rice and sugar cane, grew oranges, and fished for shrimp and oysters, while living fairly isolated lives along the banks of the Mississippi River. During the 1900s, oil, natural gas, and sulfur were discovered beneath Plaquemines' shallow marshland areas. Although the sulfur is now depleted, Plaquemines Parish was at one time the third largest supplier of sulfur in the U.S., and one of the greatest oil producers. Additionally, the parish provides one of the largest portions of the Nation's seafood. Some of the principal communities are Belle Chasse, Pointe a la Hache, Buras, Triumph, and Venice.

Census data from 2000 placed the population of Plaquemines Parish at 26,749. According to recently released data from the USCB (2010), Plaquemines Parish's population in 2010 was 23,042, a decline of 3,715 residents from the 2000 population count.

The Devastation of Hurricanes Katrina and Rita **Immediate Post-Hurricane Katrina Conditions**

When Hurricane Katrina hit, it devastated many parts of the HSDRRS area, especially Orleans, St. Bernard, and Plaquemines parishes, resulting in a tremendous loss of these parishes' population (Rudowitz et al. 2006; USCB 2010).

Orleans Parish had a pre-Hurricane Katrina population of 452,170, and by July 2006 the USCB (2010) reported that Orleans Parish had approximately half of its pre-Hurricane Katrina population return (223,388 persons). However, the Louisiana Health and Population Survey, conducted after the 2006 USCB survey, estimated the parish's population at 191,139, an estimate approximately 14 percent lower than the USCB's estimate (Rudowitz et al. 2006).

Impacts of Hurricane Katrina included loss of life, destruction of homes and businesses, damage and disruption to public facilities and services, high unemployment, loss of income, disruption and closure of local institutions, and in many cases the loss of neighborhood unity. The destruction of so many thousands of housing units delayed the immediate return to the metropolitan area for many residents, whether or not employment was available.

Orleans Parish was heavily impacted from Hurricane Katrina with widespread damage to housing and other infrastructure. It has been estimated that approximately 80 to 85 percent of New Orleans was flooded with 6 to 20 feet of water. The storm displaced more than a million people in the Gulf Coast region, with up to 600,000 households still displaced a month later. At the peak of immediate post-Hurricane Katrina needs, hurricane evacuee shelters housed approximately 273,000 people, and once FEMA trailers were brought into the region, they housed at least 114,000 households (GNOCDC 2010b). However, by late August of 2006, the number of families living in FEMA trailers decreased by 70,000 (GNOCDC 2010b).

The limitations of existing systems and their costs when failures occur can be catastrophic, as in the case of Hurricane Katrina, and to some degree Hurricane Rita. According to Gray and Hebert (2006), hospitals cared for some of the city's most vulnerable people, but they also presented some of its most difficult challenges once flooding made evacuations necessary. In the days after Hurricane Katrina struck and the New Orleans' infrastructure failed, hospitals and other organizations that had custodial responsibility for various individuals (such as nursing homes and jails) faced special difficulties. In some two dozen hospitals, patients had to be evacuated because of the loss of power, water, and sewage service, and many of these hospitals needed external assistance, which was slow to arrive. Meanwhile, patients' needs for care continued unabated. Some hospitals evacuated all patients successfully, but this was not the case for all facilities.

During this time, according to the Louisiana Hospital Association, 11 hospitals housed more than 7,600 people in addition to their patients and staff. Conventional modes of transportation were used to evacuate a dozen or so hospitals that were not isolated by water. Evacuation from the 11 hospitals surrounded by floodwaters posed the most difficult problems, requiring the use of boats and/or helicopters (Gray and Hebert 2006). The Superdome and New Orleans Convention Center became refuges for patients, their families, and thousands of others who were forced to leave their homes.

Mobile Disaster Medical Assistance Teams (DMATs) were placed throughout the region and continued operating in some areas for many months with an additional mobile team set up in St. Bernard Parish (FEMA 2005). The U.S. Department of Health and Human Services assessed the types and numbers of facilities listed below in late 2005 after the hurricanes (FEMA 2005):

- Mobile Units
 - Orleans Parish - 7
- Clinics
 - Jefferson Parish - 8
 - Orleans Parish - 7
- Temporary Care Clinics or DMATs
 - St. Bernard Parish - 2
 - Plaquemines Parish - 2
- Hospitals
 - Orleans Parish - 7
 - Jefferson Parish - 3

The Louisiana Recovery Authority (LRA) estimated that over 1,500 fatalities occurred from Hurricanes Katrina and Rita combined, and as of 2007, 135 residents were still missing. Hurricanes Katrina and Rita reduced the availability of health care, schools, police, and fire

protection. National Guard troops were brought in to assist the region. Many services were unavailable following the hurricanes. Police and firefighters were placed in the difficult position of not returning to work as their homes were damaged or unlivable, causing a large decrease in staff, which greatly reduced these services. Some facilities remain closed, and dislocated employees might never return to the area (GNOCDC 2010a).

The following is a parish-by-parish breakdown of health care, schools, police protection, and fire protection within the five-parish HSDRRS project area.

St. Charles Parish

Health Care

The St. Charles Parish Hospital in Luling, Louisiana, approximately 20 miles northwest of New Orleans, evacuated their patients before Hurricane Katrina made landfall. The hospital's patients were evacuated on Sunday afternoon in advance of the approaching storm (Gray and Hebert 2006).

Besides suffering severe wind damage, the medical facilities in St. Charles Parish were either nominally affected or were brought back into operation shortly after the storm passed. Additionally, these facilities took in many of the medical patients from the remaining four parishes that needed immediate care. Immediately after Katrina, St. Charles Parish had the 56-bed St. Charles Hospital available with other nearby parishes able to provide additional healthcare services as listed below (River Region Economic Development Initiative 2010).

- River Parishes Hospital, LaPlace (St. John the Baptist Parish) - 106 beds
- LaPlace Rehabilitation Hospital (St. John the Baptist Parish) – 22 beds
- St. James Parish Hospital, Litcher (St. James Parish) – 47 beds

Schools

Parish schools remained closed for 12 days following Hurricane Katrina. The district sustained more than \$5 million of damage, including destroyed portables, roofs blown from buildings, gymnasium and stage floors destroyed by water, and broken windows. The district lost all power during the storm. As of 2009, there were between 850 and 900 students displaced from other school systems that were still being educated in St. Charles Parish schools (Cancienne 2009).

Police Protection

The population and traffic counts on the highways within St. Charles Parish soared after the storm. According to census estimates released in October 2005, the flood of new residents boosted the population of St. Charles Parish substantially, from 50,000 to 65,000 people. This was naturally followed by a spike in the overall crime rate, but the situation was temporary. Most residents that were displaced from other damaged parishes returned to their previous homes or migrated out of the area (Scallan 2010).

Fire Protection

The fire departments in St. Charles Parish were minimally affected by Hurricane Katrina. However, members of the St. Charles Fire Department were crucial in the support offered to the other parishes impacted by the storm.

Jefferson Parish

Health Care

Only three of Jefferson Parish area's hospitals operated throughout the hurricane: East Jefferson General Hospital, West Jefferson Medical Center, and Ochsner Clinic Foundation. After the Charity Hospital System closed, the burden to treat uninsured patients fell on the two public

hospitals within Jefferson Parish - East Jefferson General Hospital and West Jefferson Medical Center (Health Affairs 2006).

Schools

Hurricane Katrina severely damaged the school system in Jefferson Parish, damaging five schools and destroying five other school facilities. According to the Jefferson Parish School Board's website, 5 weeks after the storm, 85 principals and 3,300 teachers returned to work and reopened 80 schools. Two trailer parks were specifically built to house school employees who had lost their homes (Jefferson Parish Public School System 2007). However, only 27,122 students returned to the Jefferson Parish public schools, considerably less than the 49,000 students who attended the first day of school on August 22 of that year. The student enrollment figures came from 76 of the schools that reopened that day, although five could not reopen because of hurricane damages. Additionally, the school district registered 2,611 new students (Capochino 2005a).

The Jefferson Parish Public School System sustained approximately \$40 million in direct damage to its physical plants from Hurricane Katrina, and \$300,000 in damages from Hurricane Rita (Louisiana Department of Education 2005). Through a public assistance grant from FEMA, Jefferson Parish provided more than 75 temporary classrooms to house more than 1,800 displaced students at four school sites.

Police Protection

During Hurricane Katrina, the five-story Jefferson Parish Sheriff's Office building located in Harvey was severely damaged by water and flying debris. During emergencies, the office is and was used as a shelter and command center for the sheriff's department operations (FEMA 2007b).

Fire Protection

The Jefferson Parish Fire Department consists of a large number of volunteer and paid firefighters on both the West and East Bank of the Mississippi River. The Kenner and East Bank Consolidated Fire Departments are the only two in the parish with paid firefighters. There are 19 fire departments operating in the parish area (Jefferson Parish Fire Department 2010). Fire protection personnel worked unscheduled overtime in the aftermath of Hurricane Katrina; however, much of this overtime was reimbursed by FEMA (Jefferson Fire Fighters Association 2010). Hurricane Katrina severely damaged two of nine East Bank Consolidated Fire Department stations. Those two buildings are being rebuilt for \$5.3 million and paid for with millage money. Two years after Hurricane Katrina, the Jefferson Parish fire departments were at or near full operational status (Jefferson Parish Fire Department 2010).

Orleans Parish

Health Care

Some medical clinics and hospitals in Orleans Parish damaged by Hurricane Katrina reopened soon after the storm subsided. However, numerous medical centers devastated by floodwaters remained closed and the number of pre-Hurricane Katrina beds available to the sick was reduced by 50 percent. Charity Hospital, which for generations provided care to the poor and uninsured in Orleans Parish, flooded during Hurricane Katrina and has been closed since the August 2005 storm. Local clinics handled most emergencies and were able to quickly determine if a patient needed to go to a hospital and, if so, arranged the transfer to a nearby parish hospital (Marcheta, et al. 2007).

Schools

The public school system, widely viewed as one of the worst in the Nation prior to Hurricane Katrina, was devastated after Hurricane Katrina. The city's students and teachers were quickly scattered around the country. Altogether an estimated 250,000 residents evacuated to Houston, and thousands of students entered the Houston public schools. Orleans Parish suffered significant losses of infrastructure due to Hurricane Katrina. The flooding caused by the storm resulted in the condemnation of many of the existing schools in the parish (photograph 4-10). The New Orleans Recovery School District was created before Hurricane Katrina by legislation passed in 2003 as a special district administered by the Louisiana Department of Education (Louisiana Recovery School District 2010). Immediately after Katrina, the New Orleans Recovery School District was greatly expanded by the Louisiana state legislature to include almost all of the schools within New Orleans (Chang 2010).



Photograph 4-10. Condemned school in Orleans Parish.

Police Protection

Prior to the storm, the New Orleans Police Department employed 1,721 police officers, correctional officers, and civilians. Immediately after the storm, 62 police officers voluntarily resigned, 46 officers abandoned their posts and did not return, 18 officers resigned under investigation, 11 were terminated for neglect of duty, 11 retired, and three died. As of December, 2005, the New Orleans Police Department had lost 151 officers, seven civilian employees, and two correctional officers, which is a reduction of nearly 10 percent (Capochino 2005b). The Louisiana State Police and National Guard troops that assisted in enforcing the law after Hurricane Katrina were released in late 2007 (Williams 2009a).

Fire Protection

In the first few days after Hurricane Katrina, Orleans firefighters fought several large fires that raged throughout the city and rescued thousands of residents who were trapped by the rising water in the attics and on their rooftops of their homes. Over 62 percent of the 654 Orleans firefighters lost their homes, and for over a year, hundreds of these firefighters were separated from their families (Tak et al. 2007).

Most of the fire stations in Orleans Parish sustained substantial damage from Hurricane Katrina. The St. Claude/Florida Avenue Station was housed at its pre-Hurricane Katrina location, but within a trailer. The Holy Cross Station moved from their damaged headquarters on 6030 St. Claude Avenue to the corner of North Claiborne Avenue and Caffin Avenue (Kruger 2009).

St. Bernard Parish

Health Care

The 200-bed Chalmette Medical Center sustained heavy flood damage during Hurricane Katrina. Flooding caused more than 12 ft of water to cover the entire first floor. Just weeks prior to the storm, the medical center had opened a \$17 million wing. The adjacent 47,000 square ft medical office building and a nearby physical rehabilitation skilled-nursing facility were also severely damaged during the storm and subsequent flooding. The Chalmette Medical Center was condemned in the fall of 2006 and had to be demolished along with the adjacent medical services buildings in February 2007 (Turni Bazile 2007).

In April 2006, there were limited medical services available in St. Bernard Parish. The St. Bernard Health Center, a 22,000 square ft prefabricated temporary facility, opened in May 2007.

In order for this center to open, it was financially supported by FEMA and Chalmette Refining and was operated by the Franciscan Missionaries of Our Lady Health System and Ascension Health (Louisiana Speaks 2007).

Schools

Prior to Hurricane Katrina, the St. Bernard school district serviced approximately 8,800 students, from grades Pre-K through 12, at its 15 school sites. During the storm, each of those sites was devastated, some beyond repair. However, just 11 weeks after the storm, the St. Bernard Parish Public Schools reopened one school, the St. Bernard Parish Unified School, in temporary trailers on the football field parking lot and on the second floor of Chalmette High School (St. Bernard Public Schools 2007).

The following is a listing of what were found to be the most structurally sound buildings and repairable sites within the parish directly after the storm (FEMA 2007a).

- Andrew Jackson High School
- N.P. Trist Middle School
- Gauthier Elementary School
- Rowley Elementary School
- Sebastien Roy Elementary School
- Maumus Center
- Chalmette High School
- St. Bernard High School

Police Protection

In St. Bernard Parish, all but an estimated five of 27,000 residences received water damage, as well as nearly all 3,000 businesses and government buildings, including those operated by parish government, the Sheriff's Office, the School Board, and the Lake Borgne Basin Levee District Board (Cannizaro 2010).

The St. Bernard Sheriff's Department office was condemned after Hurricane Katrina. Staff and equipment in the Sheriff's office were consolidated, and the department experienced a significant reduction in staff and equipment. However, by 2006, the Sheriff's department was performing its regular functions within St. Bernard Parish (Louisiana Speaks 2006).

Fire Protection

Days after Hurricane Katrina, an estimated 27,000 to 29,000 homes in St. Bernard Parish were inundated by 3 to 14 ft of water. The local firefighters of the parish were the first to respond, performing search and rescue, providing emergency medical services, and extinguishing fires (Ruiz 2007).

The St. Bernard Parish Fire Department suffered personnel and equipment losses and operated out of a damaged building and a temporary station in a group trailer site. By April 2006, there were approximately 100 active firefighters, and the department had on hand six fire apparatuses, two squad units, a tanker, and a mini pump. A large percentage of equipment for the Sheriff and Fire Departments was destroyed, and the U.S. Forest Service was assisting operations by supplying manpower and vehicles (Louisiana Speaks 2006).

A year after Katrina, the Chief of the Fire Department estimated that the department's firefighting capability was at 45 percent of pre-Hurricane Katrina levels. The department was still working out of seven mobile homes used as temporary fire stations, strategically placed throughout the parish (Louisiana Speaks 2006).

Plaquemines Parish

Health Care

All health care and medical services were interrupted in Plaquemines Parish for some time after Hurricane Katrina. The residents of lower Plaquemines Parish (below Belle Chasse) had one medical center in Port Sulphur. Otherwise, residents used medical facilities in the New Orleans area (PlaqueminesParish.com 2010).

Schools

Plaquemines Parish lost all of its local government and many of its school district facilities. The Buras Middle School and High School were badly damaged. The Port Sulfur Middle School and High School held classes in temporary facilities. New teacher housing was constructed at the site where the Buras High School stood. On the East Bank of the Mississippi River, both the Phoenix Grade School and High School held classes in temporary structures (photograph 4-11).



Photograph 4-11. Phoenix High School Gym enclosure.

In 2006, of the 14 schools that once existed in Plaquemines Parish, seven were reopened, six were demolished, and one was under construction (Plaquemines Parish School Board [PPSB] 2010a).

Police Protection

As a result of Hurricane Katrina, the Sheriff's Office communications system was decimated. The 911 Communications Center and Lock-up Facility located in Port Sulphur were flooded with at least 18 ft of water, and as a result, the communications equipment and holding areas were lost.

Communications immediately after Katrina and for days following the storm were limited from short-range to no communications in the southern regions of the parish, while the northern portion of the parish utilized an overwhelmed backup radio system (Hingle 2006). Photograph 4-12 is of the temporary structures housing the Port Sulphur Sheriff's Office.



Photograph 4-12. Port Sulphur temporary Sheriff's Office.

The infrastructure of the Sheriff's Office was subject to various degrees of damage from light to total destruction (Hingle 2006). As a result of the storm, the Sheriff's Office lost 56 deputies. The reasons stated for this loss of staff ranged from personal to the relocation of the officer's families outside the region and the state. This loss of personnel decreased staff from a pre-Hurricane Katrina high of 244 to a 2006 level of 180 (Hingle 2006). The Sheriff's Office homeland security mission remained stable after Katrina, except for the temporary loss of the security detail at the Conoco-Phillips refinery. Prior to Hurricane Katrina, the Sheriff's Office had a total of 14 individual office buildings and locations within the parish.

The following is a breakdown by facility of the damage caused by the storm (Hingle 2006):

- The Adult Detention Center located in Davant, on the lower east bank of the parish was devastated by a 20 ft storm surge and winds over 125 mph. The Detention Center was a 91,000 square ft facility, which could house approximately 875 inmates and also contained a courtroom, and inmate visitation area, and the administrative offices for the center. The Adult Detention Center was declared a total loss.
- The 2nd District Lockup and Dispatch Center in Port Sulphur received an 18 ft storm surge and was considered to be a total loss.
- The 3rd District Office and East Bank Substation in Woodlawn was abandoned due to wind damage as a result of Katrina and was relocated to another building in Belle Chasse.
- The Marine Search and Rescue Facility in Port Sulphur was a large warehouse facility, which contained office space for officers, a workshop area, and a storage area for marine patrol vessels. This building received major structural damage from an 18 ft storm surge and was considered to be a total loss.
- The 2nd District Detective Bureau in Port Sulphur consisted of four offices, and contained crime scene equipment, and interview and interrogation equipment. The structure was totally destroyed by an 18 ft storm surge.
- The Juvenile Detention Center at Port Sulphur was a 15-bed facility that housed juvenile offenders. This single-story facility had storm surge over its roof and was considered a total loss.
- The Tax Collection and Human Resource Office at Pointe a la Hache was a 2,400 square ft facility that provided office space for the tax and human resource personnel. This structure was totally destroyed, as well as the Evidence Room and Archived Criminal Records Room at Pointe a la Hache.
- The Training Complex and Junior Deputy Campground Park in Myrtle Grove consisted of a complex of five buildings. The storm surge swept most of these structures away and totaled those left standing.

Additionally, a total of 20 vehicles were lost as a result of flooding, accidents, and mechanical issues directly attributed to the hurricane and response efforts (Hingle 2006).

Fire Protection

Although most of the physical infrastructure of the Plaquemines Parish Fire Department was severely damaged due to Hurricane Katrina, the all-volunteer fire department was able to operate efficiently during and after the storm. The following is a list of all of the divisions in Plaquemines Parish that were in operation immediately after Katrina:

- Point a la Hache Volunteer Fire Department
- Belle Chasse Volunteer Fire Department
- Port Sulphur Volunteer Fire Department
- Buras Volunteer Fire Department
- Boothville-Venice Volunteer Fire Department
- Lake Hermitage Volunteer Fire Department
- Callender NAS Fire Department
- Woodlawn Volunteer Fire Department

Pre- and Post-Hurricane Katrina Comparisons and Recovery Summary

The devastation of Hurricane Katrina to southeast Louisiana, especially to an urban city such as New Orleans, captured the attention of the Nation and the world (Giudici 2008). In many ways, post-Hurricane Katrina conditions and ultimately its recovery became a living laboratory to learn about natural disasters and even man-made disasters, and was closely watched and extensively covered by many organizations (governmental, private, and public) (Giudici 2008). One such organization that took on the daunting task of providing data for post-Hurricane Katrina impacts and the slow recovery which followed was the GNOCDC. Operating since 1997, the GNOCDC's mission is to gather, analyze, and disseminate data to help nonprofit and civic leaders work smarter and more strategically (GNOCDC 2010b). GNOCDC, working with the Brookings Institute, became a clearinghouse for information throughout the early post-Katrina recovery efforts and continues to do so today. Much of the data utilized for the socioeconomic pre- and post-Hurricane Katrina comparisons was originally sourced from this non-profit organization.

Since the devastation of the 2005 hurricane season, much of the project area has changed. Recent 2010 demographic information for the Greater New Orleans Metropolitan Area includes the following statistics, which illustrate the region's changing demographics:

- The share of African Americans in the city is now 60.2 percent, which is down from 66.7 percent in 2000 but has been steadily increasing since its lowest point of 57.8 percent in 2006.
- The percent of the city's households that include children has fallen dramatically from 30 percent in 2000 to 22.7 percent in 2010, and across the metropolitan area the percent of households with children has fallen from 34 to 28 percent.
- In New Orleans, the share of the population that is Hispanic has grown steadily from 3.1 percent in 2000 to 5.2 percent in 2010 and from 4.4 percent to 7.9 percent across the metropolitan area.
- The percent of New Orleans households without a vehicle fell from 27 percent in 2000 to 20 percent in 2008 (which is the year with the most recent available data), and across the metropolitan area has fallen from 15 to 9 percent of all households by 2008 (GNOCDC 2010b).

As the city moves closer to its pre-storm population, some of these demographic changes may persist while others may be a temporary result of Katrina. The future demographic profile of New Orleans will be largely influenced by the overall job market, the availability of affordable housing, residents' confidence in schools and other critical services, and the ties to the city of its displaced residents (GCR and Associates 2010).

In the project area in 2010, the average wages in the metropolitan area have increased 15 percent from 2004 to 2009 and the July 2010 labor force for the region reached 87 percent of its level from 5 years earlier (GNOCDC 2011). Post-Hurricane Katrina recovery has also had an unexpected increase in entrepreneurship, with 427 of every 100,000 adults in the metropolitan area starting a business as compared to 333 of every 100,000 adults nationally (GNOCDC 2011).

Although the rest of the Nation experienced severe job losses during the 2008 to 2009 recession, New Orleans experienced relatively mild job losses. For the period from July 2008 to July 2010, the Greater New Orleans Metropolitan Area lost only 0.8 percent of all jobs, while the Nation lost 5.0 percent of all jobs (GNOCDC 2010c). However, although the area job loss rate was less than National losses, the recession did slow the metropolitan area post-Hurricane Katrina jobs recovery, so that by July 2010 there were 89,000 fewer jobs (15 percent) than 5 years earlier

(GNOCDC 2010c). This has resulted in rising unemployment, with percentages in the metropolitan area at 7.5 percent in July 2010 up from 4.5 percent in July 2008 (GNOCDC 2010c). By November 2011, the unemployment rate had dropped to 6.5 percent (U.S Bureau of Labor Statistics 2012).

In April 20, 2010, the recovery was again hampered by the BP Deepwater Horizon rig explosion and major oil spill in the Gulf of Mexico. The around-the-clock news reports of oil coursing into the Gulf of Mexico with images of brown pelicans covered with crude oil and a Federal drilling moratorium exposed the economic fragility of the region. This has impacted a large portion of the population that was either directly involved in the seafood or oil industries or that suffered indirect impacts (e.g., bait and tackle shops, boat dealers, fuel sales, restaurants). In a recent survey taken while the oil was still flowing unchecked, half of New Orleans' residents surveyed said the economic damage from the oil spill would surpass what Hurricane Katrina caused (Hammer 2010).

The oil spill and the Gulf of Mexico drilling moratorium that followed, began to damage key industries that drive the New Orleans regional economy, causing 2.5 percent fewer natural resources and mining jobs in July 2010 as compared to 1 year earlier, even as these same types of jobs increased nationally by 6.7 percent (GNOCDC 2010c). Tourism in the area decreased, and although the New Orleans sales tax collections stalled in 2008 from January through July 2010, tax collections were 8 percent lower than the same months in 2005. At the height of the oil spill in the summer of 2010, BP hired more than 10,000 local boats and their captains as part of the Vessels of Opportunity program; however, by September of 2010, the company employed only 810 vessels and the program is scheduled to be phased out soon (Jervis 2010).

In a study commissioned by a regional economic development agency in October 2010, the *Times-Picayune* reported that the short-term gross revenue loss to the fishing industry from the Deepwater Horizon oil spill could be approximately \$115 million to \$172 million from 2011 to 2013. This study, the first of three studies commissioned, focused exclusively on the short-term economic impact of the spill on fisheries, the fishing industry, and fishermen. The study did not include any potential long-term ecological effects or changes in demand for Gulf seafood, and did not include impacts on related industries, such as seafood processing and recreational fishing. The revenue losses equate to a job loss of 2,650 to 3,975 "full time equivalents" and an earnings loss of \$68 million to \$103 million for the period of time from 2011 to 2013 (White 2010).

Population and Housing

Population and housing in the post-Hurricane Katrina recovery were and continue to be integrally related to each other and in many ways are the most measurable methods of depicting the HSDRRS project area storm recovery. Hundreds of thousands of homes were destroyed by the 2005 storms, which caused an immediate escalation in home prices and rental rates for the remaining habitable housing. In addition to uncertainty with the hurricane protection system, environmental concerns from the flooding, insurance compensation, and FEMA insurance program requirements (NFIP) became factors in how many people could or would return to their homes after the storms.

Table 4-41 shows Census population estimates from pre-Hurricane Katrina (July 1, 2005 estimate) to 2009 and actual 2010 data from the 2010 Census. Note that a sharp population decline occurred in Orleans and St. Bernard parishes and a lesser but substantive decline occurred in Plaquemines Parish between 2005 (pre-Katrina estimate) and 2006 due to the severe damage caused by the storm. The population of Jefferson Parish also declined after the storm, but the decrease was small in comparison to St. Bernard, Orleans, and Plaquemines parishes. The least storm-affected parish, St. Charles, actually gained population after Katrina. It suffered only minimal damage, and subsequently absorbed some of the population displaced from the

other four parishes. From 2006 to 2007, populations increased in all the affected parishes. Annual increases continued through 2010, with the exception of slight decreases in the estimates for Plaquemines and St. Charles parishes between 2007 and 2008. In 2010, the region as a whole was still almost 20 percent below pre-Katrina population levels. St. Bernard was down almost 50 percent, Orleans Parish down 30 percent, and Plaquemines Parish was down by 22 percent. Only St. Charles Parish gained population between 2005 and 2010, showing a 4.2 percent growth rate.

Table 4-41. Population of the HSDRRS Project Area, Pre-Hurricane Katrina through 2010

Parishes	Population Estimates ¹							Percent Change 2005* - 2010
	2000	2005*	2006	2007	2008	2009	2010	
Jefferson	455,406	456,554	426,285	432,683	431,759	431,921	432,552	-5.3
Orleans	484,692	494,294	230,172	268,751	301,842	327,803	343,829	-30.4
Plaquemines	26,749	29,558	22,329	22,709	22,677	22,730	23,042	-22.0
St. Bernard	67,230	71,300	16,563	23,613	28,879	32,878	35,897	-49.7
St. Charles	48,019	50,670	52,453	52,765	52,516	52,719	52,780	+4.2
Area Totals	1,014,886	1,102,376	747,802	800,521	837,673	868,051	888,100	-19.4

Source: USCB, County Intercensal Estimates (2000-2010)

*Pre-Hurricane Katrina Estimate

¹Population estimates for 2005 – 2009 as of July 1.

The five-parish HSDRRS project area provides risk reduction for a highly urbanized area of Louisiana. Within the region's urban areas there is a wide range of services and facilities that contribute to the local tax base including numerous commercial and residential properties with a range of values; public facilities and services; utilities; public transit; streets and bridges; police and fire protection facilities and services; schools and educational services; and hospitals and health care services. Many of these properties and services were severely impacted by Hurricanes Katrina and Rita (photograph 4-13).



Photograph 4-13. Damaged properties due to Hurricane Katrina.

The Greater New Orleans Metropolitan Area is one of the largest market centers in the southeastern U.S., with unique resources that influence property values. Table 4-42 shows the increases in prices for single-family homes in the five-parish HSDRRS project area.

Table 4-42. Average Single-Family Housing Prices, 2000 and 2005 through 2010

Parish	Average Housing Price 2000	Average Housing Price 2005	Average Housing Price 2006	Average Housing Price 2007	Average Housing Price 2008	Average Housing Price 2009	Average Housing Price 2010	Change 2000-2005	Change 2005-2010	Change 2000-2010
Jefferson	\$145,960	\$200,408	\$211,053	\$215,547	\$199,070	\$187,095	\$184,286	37%	-8%	26%
Orleans	\$155,232	\$237,768	\$226,716	\$189,610	\$205,970	\$214,358	\$254,309	53%	7%	64%
Plaquemines	\$150,076	241,293	\$273,391	\$286,753	\$255,402	\$302,976	\$225,916	61%	-6%	51%
St. Bernard	\$89,429	114,433	\$49,791	\$76,913	\$98,151	\$100,772	\$102,744	28%	-10%	15%
St. Charles	\$147,533	\$186,396	\$229,826	\$222,471	\$213,269	\$199,402	\$197,854	26%	6%	34%

Sources: UNO 2002, UNO 2006, UNO 2012

Because many housing units that were not destroyed by the hurricane were severely damaged, many people who lived in apartments or multi- and single-family units were unable to return following Hurricane Katrina. By 2008, many of the people who returned to the metropolitan area were still living in FEMA trailers while housing units were being repaired or reconstructed.

The American Red Cross estimated that about 135,000 housing units in the New Orleans metropolitan statistical area were destroyed by Katrina, while many more were severely damaged. According to the GNOCDC, in New Orleans alone 134,000 housing units, or 70 percent of all occupied units, suffered damage from Hurricane Katrina and the subsequent flooding (GNOCDC 2010b). This enormous loss of housing in Orleans and St. Bernard parishes was also reflected in the population recovery trends (see table 4-41). Following Hurricanes Katrina and Rita, close to 100 percent of the homes in St. Bernard Parish were officially deemed uninhabitable (St. Bernard Project 2009).

Pre-Hurricane Katrina, there was a high percentage of rental units in Orleans and Jefferson parishes, while the other parishes within the HSDRRS project area were mostly comprised of owner-occupied housing units. Figures 4-12 and 4-13 show that, as the parishes recovered from storms, it was the owner-occupied units that were the first to be repaired and renovated, which provided a secure place for parish residents to live. In 2004, 43 percent of renters within New Orleans paid more than 35 percent of their pretax income on rent and utilities as compared to 2008 when this number rose to 58 percent (GNOCDC 2010b). This created a situation where affordable rental housing, needed by many low-income families in order to return to the project area, was difficult to find.

Figure 4-12. Housing Units in Project Area, 2000

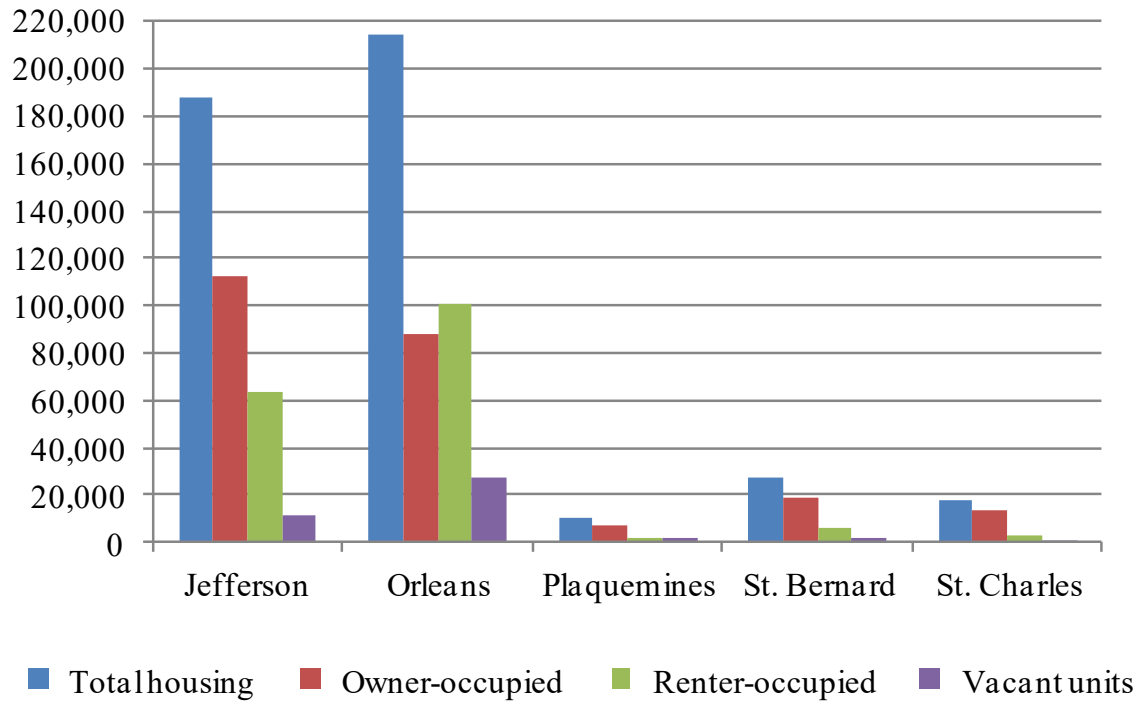
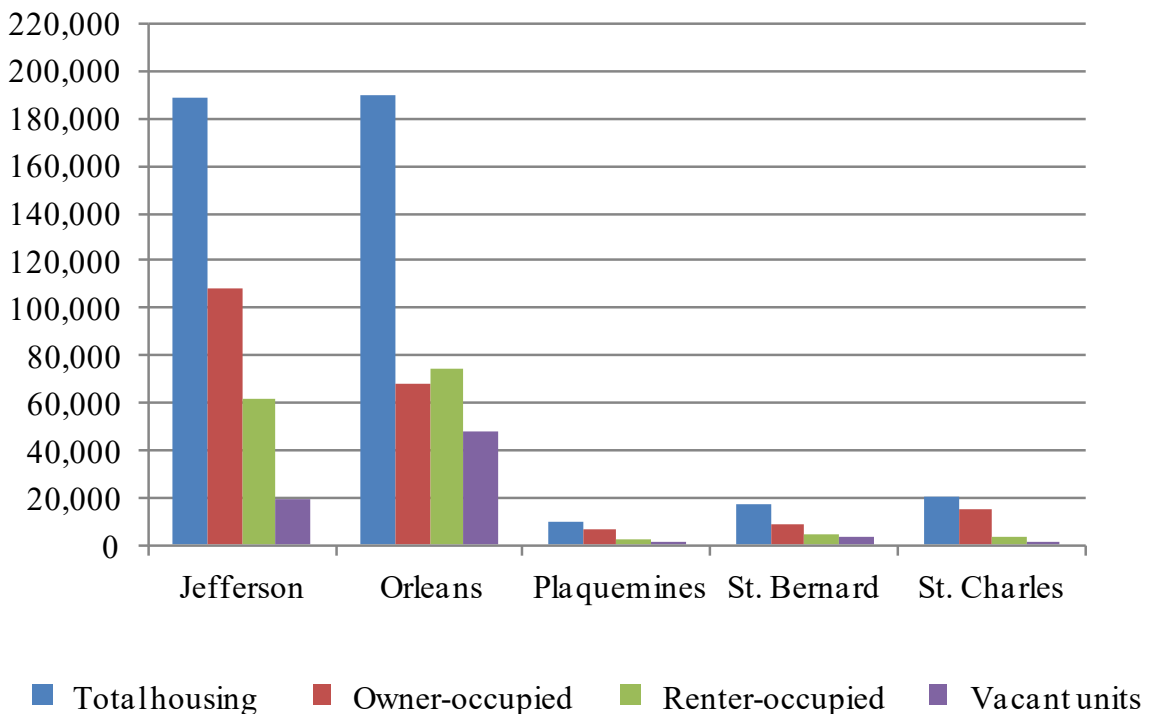


Figure 4-13. Housing Units in Project Area, 2010



Since January 2006, more than 80,000 residential properties have been placed back into service or are in the process of rehabilitation. However, there is still substantial blight in the city, with many homes that were active pre-storm yet to be repaired. There are currently an estimated 35,200 residential units that were active pre-Hurricane Katrina but are not active today (GCR and Associates 2010).

Housing programs, both Federal- and state-run, although predominantly funded by Federal aid, have played a large role in Louisiana's post-Katrina housing recovery and have gone a long way toward subsidizing homeowners' efforts to rebuild. For example, in Orleans Parish alone, more than 46,000 homeowners had received Road Home grants averaging approximately \$91,000 as of February 2012 (LRA 2012). Nonprofit organizations have filled an important niche within the region and have teamed with state and Federal agencies, as well as other nonprofits, in order to help regional residents find a new home or repair an existing one. The nonprofits involved in the project area are too numerous to name, but a few of the organizations that have taken on pivotal roles in housing recovery and community revitalization are:

- Beacon of Hope Resource Center
- Build Now
- Catholic Charities Archdiocese of New Orleans
- Common Ground
- Community Center of St. Bernard
- Habitat for Humanity
- Hands On New Orleans
- Preservation Resource Center of New Orleans
- Project Homecoming
- Providence Community Housing
- Rebuilding Together New Orleans
- The St. Bernard Project

Blight is rapidly declining in the worst hit areas in the region, down from 98,402 unoccupied residential and commercial addresses in March 2007 to 64,135 in June 2010. In St. Bernard Parish, blight has fallen from 19,525 unoccupied residential and commercial addresses in 2007 to 13,927 as of 2010 (GNOCDC 2010b). New construction or newly renovated buildings are a more prevalent sight than in the earlier years following the aftermath of the storms, as shown in photographs 4-14, 4-15, and 4-16. However, throughout the HSDRRS project area, abandoned properties in certain sections of the region can still be seen in large numbers, as shown in photograph 4-17.



Photograph 4-14. Modern reconstruction near the London Avenue Canal breach.



Photograph 4-15. Rebuilt residences in the Lower Ninth Ward.



Photograph 4-16. Housing reconstruction in the New Orleans Lakeview area.



Photograph 4-17. Abandoned structure in the Lower Ninth Ward.

Business and Industry, Employment and Income

The overall storm recovery within the project area has been slow, but based upon U.S. Postal Service data by 2008, nearly 72 percent of Orleans Parish pre-Hurricane Katrina households had returned and were actively receiving mail (GNOCDC 2008). Business and industrial activities are an important component of socioeconomic resources and, as such, provide an economic base for communities and are part of a community's long-term economic stability. Table 4-43 shows labor force and employment figures, comparing data gathered in 2000 (Pre-Hurricane Katrina) to 2007 and 2011 (Post-Hurricane Katrina).

Table 4-43. Labor Force and Unemployment: Pre- and Post-Hurricane Katrina Annual Averages for 2000, 2007, and 2011

Parish	Pre-Hurricane Katrina		Post-Hurricane Katrina			
	Labor Force (2000)	Unemployment Rate (percent)	Labor Force (2007)	Unemployment Rate (percent)	Labor Force (2011)	Unemployment Rate (percent)
Jefferson	231,695	4.3	219,411	3.2	211,904	6.8
Orleans	210,684	5.1	106,509	4.5	146,037	8.8
Plaquemines	11,006	5.4	8,931	3.5	9,019	6.9
St. Bernard	32,177	5.1	9,662	3.9	16,620	7.8
St. Charles	23,892	5.2	26,031	3.4	24,899	6.7
Louisiana	2,031,296	5.0	2,010,661	3.8	2,060,645	7.3

Source: BLS

Note: Annual average unemployment rate data available by year at <http://www.bls.gov/lau/#tables>. Data for these parishes are not available for 2005 and 2006.

In 2007, post-Katrina, unemployment rates throughout the HSDRRS region were below pre-Katrina rates, as the labor force in most parishes was smaller and there was substantial recovery-related employment. By 2011, unemployment rates in the region were up substantially, as they were across the Nation, as a result of the overall downturn in the economy. While the 2011 HSDRRS region unemployment rates were higher, they were all below the U.S. average unemployment rate for 2011 of 8.9 percent.

The size of the labor force in the five-parish HSDRRS region was approximately 27 percent smaller in 2007 (post-Katrina) than in 2000. During that time period, the size of the labor force in the State of Louisiana as a whole declined 1.0 percent, with that decline caused by the substantially smaller labor force in the HSDRRS region and particularly in Orleans Parish. In 2011, the labor force in the HSDRRS region was still almost 20 percent smaller than in 2000. In 2011, the size of the state's labor force exceeded 2000 level, but the region's labor force remained smaller by more than 100,000.

Figures 4-14 through 4-18 are derived from data provided by the USCB (2010) and summarize selected information on business and industry employment in each parish (USCB 2010). These data indicate the types of employment in the parishes from 2004 to 2009. In St. Charles Parish (see figure 4-14), most sectors stayed fairly constant, with a slight growth in total employment between 2004 and 2009. Since 2004, wholesale trade increased slightly while construction and manufacturing have had slight decreases. In Jefferson Parish (see figure 4-15), overall, all employment sectors decreased since 2004; however, three employment industry sectors, mining, construction, and health care and social assistance, initially decreased in 2006, but since then, these industry sectors have all shown small sustained increases. Retail trade and professional, scientific, and technical services have shown modest decreases or have remained flat from 2004 to 2009.

Figure 4-14. St. Charles Parish Employment by Industry

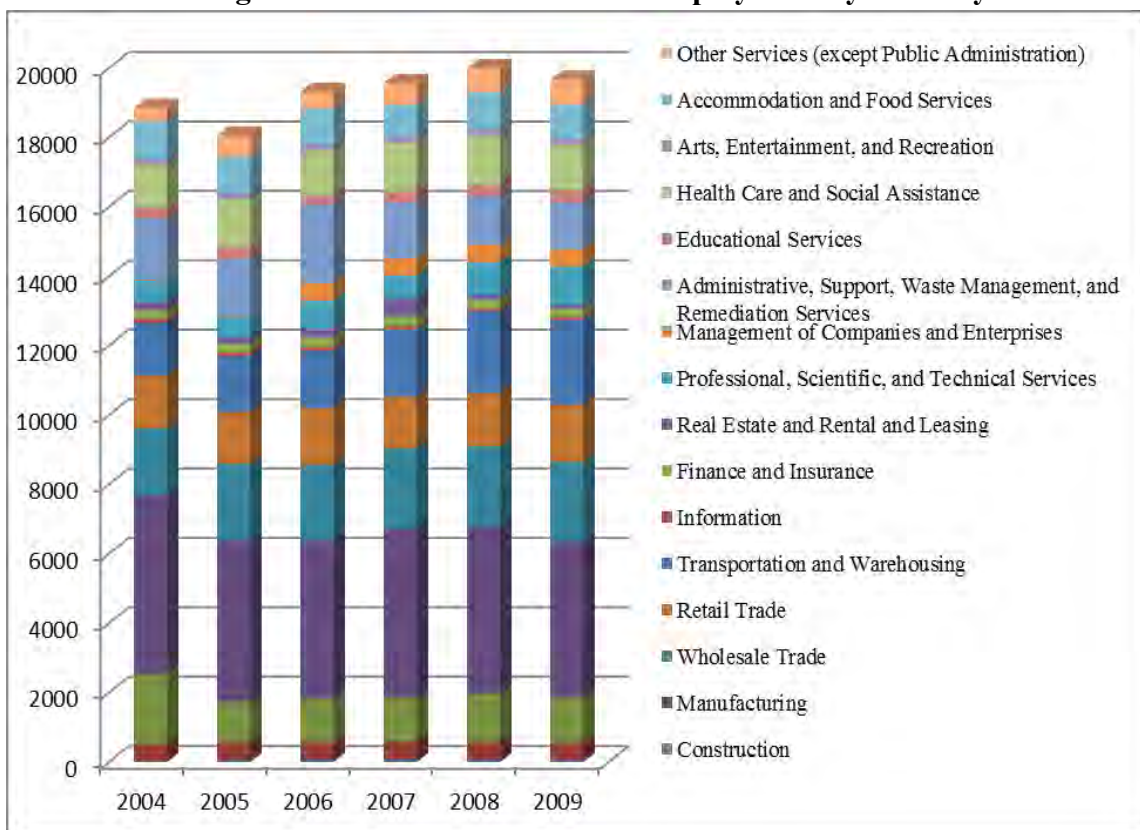


Figure 4-15. Jefferson Parish Employment by Industry

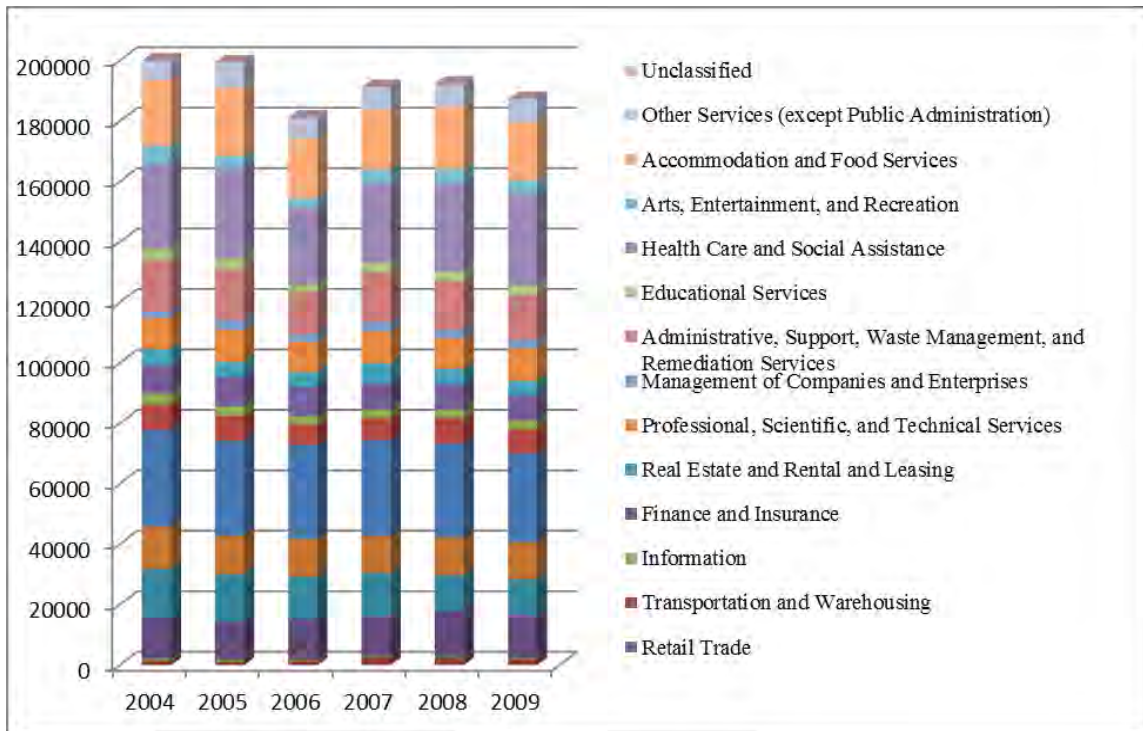


Figure 4-16. Orleans Parish Employment by Industry

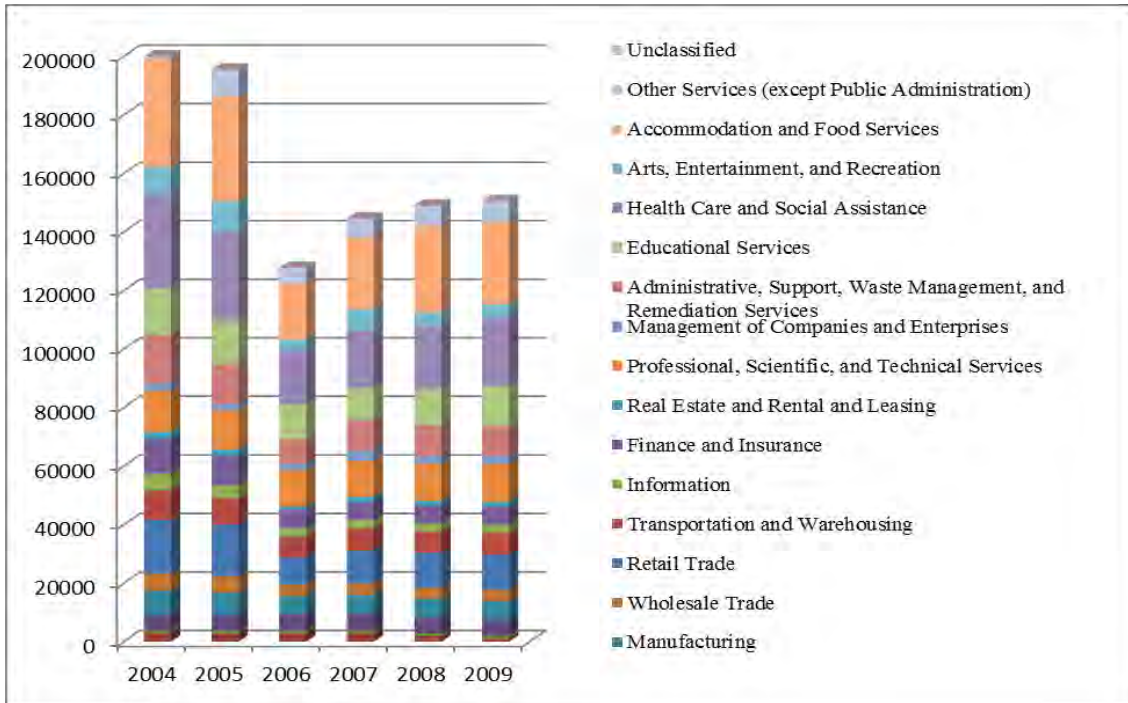


Figure 4-17. St. Bernard Parish Employment by Industry

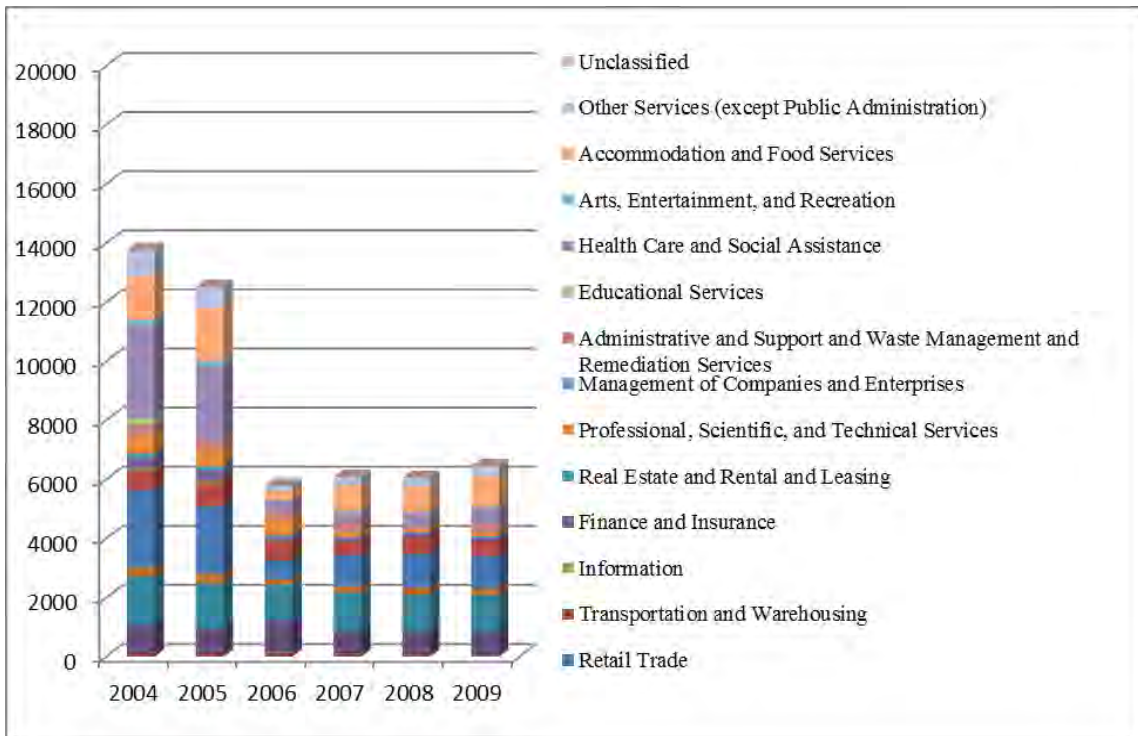
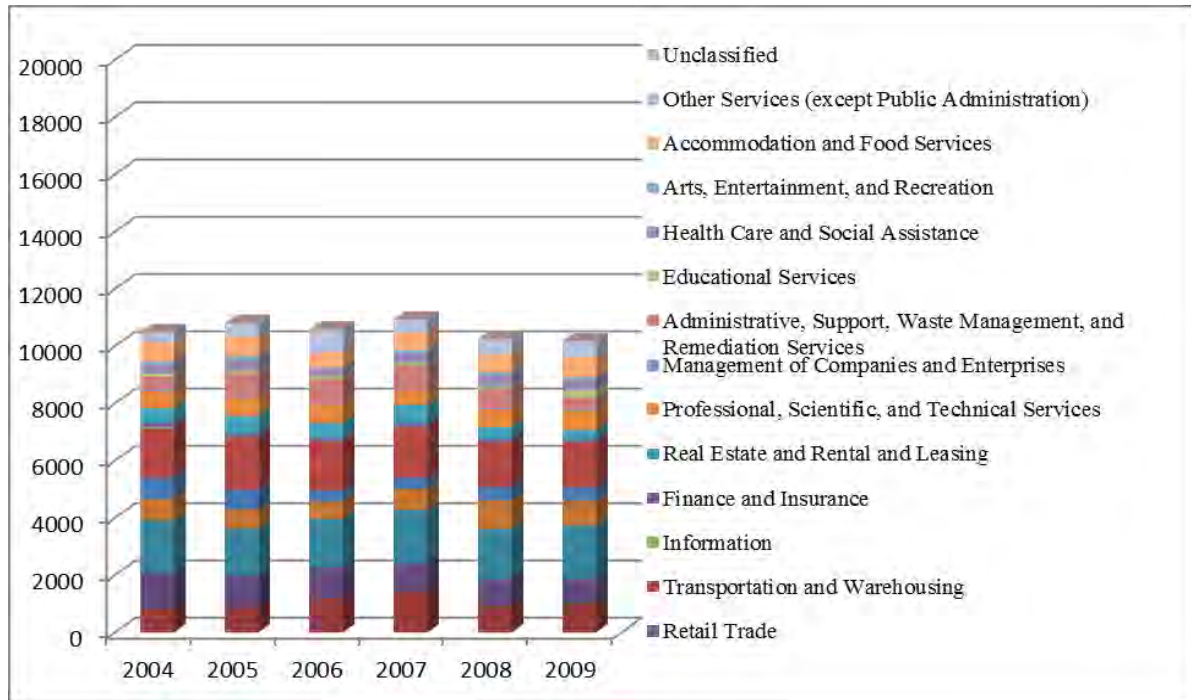


Figure 4-18. Plaquemines Parish Employment by Industry



In Orleans Parish (see figure 4-16), total employment dropped 35 percent from March 2005 to March 2006, and then began to slowly increase. By March 2009, employment totals were still down 23 percent from the March 2005 pre-Katrina totals. However, by March 2007, total employment had increased slightly, a trend that continued through the most recent data available (March 2009). While employment is still well below pre-Katrina levels in all sectors except construction and management of companies and enterprises, by March 2009, most sectors were beginning to show at least slight increases. Healthcare and social assistance, retail trade, accommodation, management of companies and enterprises, administrative/waste management, and other services showed substantial increases from March 2006 through March 2009.

In St. Bernard Parish (see figure 4-17), most employment sector levels decreased after 2005. Retail trade, professional, scientific, and technical services, and health care and social assistance had the greatest decrease in employment after 2005. No employment sectors have recovered to pre-Hurricane Katrina levels in St. Bernard Parish.

All employment industry sectors, except for construction remained relatively unchanged in Plaquemines Parish since 2004 (see figure 4-18). There has been a substantial decrease in construction employment in Plaquemines Parish between 2004 and 2009.

Tourism is a major economic driver in the New Orleans area and, prior to Hurricane Katrina, accounted for almost 40 percent of the visitors in the state, about half of all visitor spending (\$5 billion of the state's \$10 billion), and over \$360 million in tax revenues for the city. Visitor travel to New Orleans after Hurricane Katrina decreased dramatically, as did visitor spending and tax revenues. The DCRT's most recent Louisiana Tourism Forecast (Louisiana DCRT 2009b) anticipates that, while the number of visitors and visitor spending has shown slowed increase since the storms, visitation to New Orleans and the corresponding tax revenues are not expected to return to pre-Hurricane Katrina levels until after 2013.

Table 4-44 shows a comparison of median household incomes, from pre-Hurricane Katrina 2000 and 2006 through 2010 (post-Hurricane Katrina), within the five parishes, along with state and National data. All parishes within the HSDRRS project area increased in median household income. Plaquemines Parish had the greatest increase in median household income (43.4 percent), with St. Bernard Parish showing the lowest growth (9.1 percent). With the exception of St. Charles Parish, median household income in the region's parishes was below the National average (USCB 2012).

Table 4-44. Median Household Incomes, 2000 and 2006 through 2010

Parishes	Pre-Hurricane Katrina (2000)	Post-Hurricane Katrina (2006-2010)	Pre-Hurricane Katrina to 2010 Percent Change
St. Charles	\$45,139	\$60,961	+35.1
Jefferson	\$38,435	\$48,175	+25.3
Orleans	\$27,133	\$37,468	+38.1
St. Bernard	\$35,939	\$39,200	+9.1
Plaquemines	\$38,173	\$54,730	+3.4
Louisiana	\$32,566	\$43,445	+33.4
U.S.	\$41,994	\$51,914	+23.6

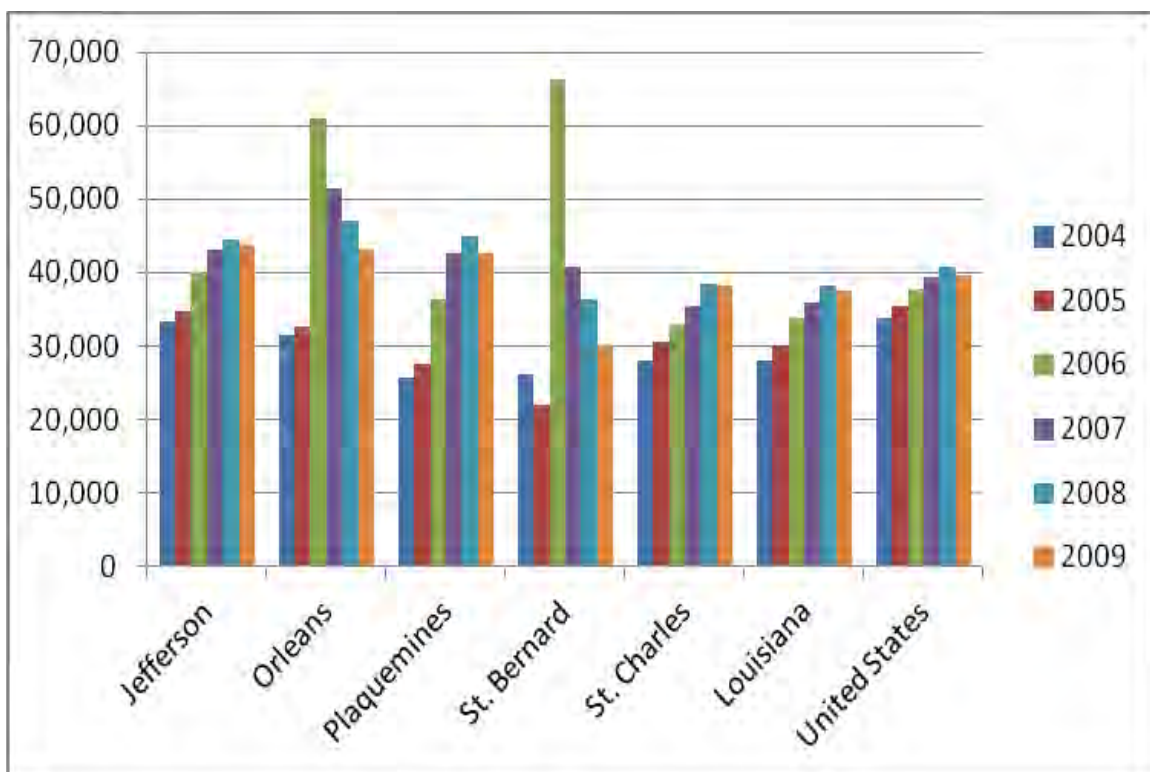
Source: USCB 2012

Per Capita Personal Income and Regional Growth

Personal income is the income that is received by persons from all sources. It is calculated as the sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustment, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance (Bureau of Economic Analysis [BEA] 2010).

Per capita personal income is the personal income of the residents of a given area divided by the resident population of the area. In computing per capita personal income, BEA uses the USCB's annual midyear population estimates (BEA 2010). Figure 4-19 shows the changes in per capita personal income in the parishes for the 6-year period between 2004 and 2009. Orleans and St. Bernard parishes had substantial spikes in per capita personal income in 2006, likely the result of the large influx of recovery funds providing higher than average wages for some workers and fewer lower income residents who had returned. Per capita personal income in Jefferson, Plaquemines, and St. Charles parishes increased every year until a slight decrease in 2009 – the same pattern seen in the state as a whole and the U.S. as a result of the recession. Per capita personal income in Orleans and St. Bernard parishes decreased in each of the years after the spike in 2006; however, in 2009 they were still substantially above pre-storm levels with Orleans Parish up by 31 percent and St. Bernard Parish up 15 percent from 2004.

Figure 4-19. Per Capita Personal Income 2004 through 2009



Community Cohesion

Community cohesion is the unifying force of conditions that provide commonality within a group. These characteristics may include such things as race, education, income, ethnicity, religion, language, and mutual economic and social benefits. Community cohesion has been

described as the unifying force that bonds people together long enough to establish meaningful interactions, common institutions, and agreed-upon ways of behavior. It is a dynamic process, changing as the physical and human environment changes. As stated in the beginning of this section, the impacts from Hurricane Katrina included loss of life, destruction of homes and businesses, damage and disruption to public facilities and services, high unemployment, loss of income, disruption and closure of local institutions, and the loss of neighborhood unity. One of the most distressing and often most traumatizing parts of the 2005 hurricane season was the loss of homes. However, this loss of homes caused and precipitated other deeper losses such as the dispersion of families and neighbors, the loss of social networks, family records, and cultural histories, and in many cases the loss of loved ones (GNOCDC 2010c). Southeast Louisiana is a region that has a long history, deep loyalties, and family lineages over generations. Specifically, New Orleans was and is a city of unique neighborhoods. New Orleans has 73 neighborhoods that were distinctive before the storms and may even have become more distinctive after the storms. Neighborhood organizations, which have been at the heart of the New Orleans recovery, have come together and organized in ways that have been largely unprecedented and thought to be impossible before the storm (GNOCDC 2010c).

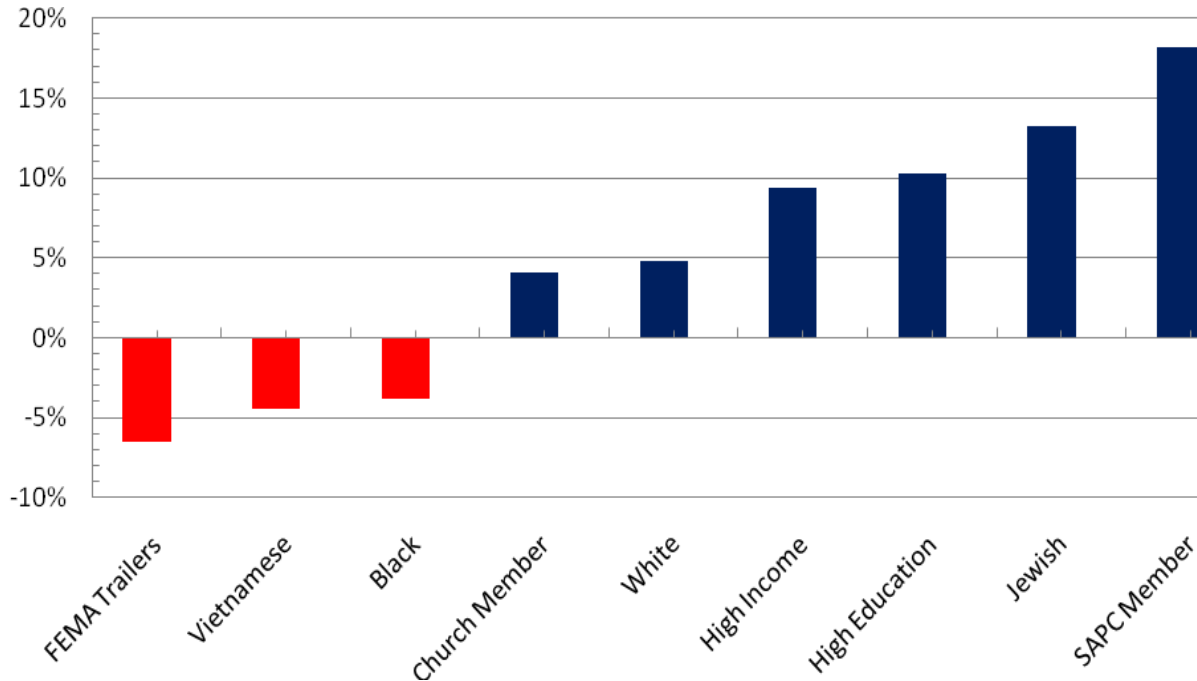
Prior to Katrina, there were a few organizations focused on community development within southeast Louisiana; however, post-Hurricane Katrina, many of these organizations grew and strengthened, and many new organizations and networks of organizations came to the aid of the beleaguered region. Specifically, many of these organizations came to the rescue of particular neighborhoods and more vulnerable populations within New Orleans. Pre-Hurricane Katrina, New Orleans was often seen as a city that displayed high levels of citizen passivity, intercommunal conflict, and corruption. These new organizations grew out of a sense of cultural continuity, community cohesion, and the need to restore the social fabric destroyed by the scattering and disbursement of people in the region and in their own neighborhoods. In New Orleans, much of this action by organizations was spurred by the Bring New Orleans Back Commission, which announced in November 2005 that heavily flooded neighborhoods would have to prove their viability and warrant city investment by the number of returning residents to the flooded and damaged neighborhoods (GNOCDC 2010c).

Engaged in recovery discussions and armed with this invigorated sense of community, residents wanted to rebuild their communities to be safer, stronger, and more equitable. Paramount to these broader social issues was providing greater opportunities to residents upon returning (GNOCDC 2010c).

Community developers have focused on bringing back entire blocks at a time in order to try and stabilize neighborhoods. One such effort has been Musician's Village, which features 82 homes and a performing arts center.

While civic engagement has grown post-Hurricane Katrina, it has not been completely equitable, as seen in data taken by the LSU Disaster Recovery Survey (figure 4-20). More affluent, educated people or people affiliated with strong community-driven organizations, such as Social Aid and Pleasure Clubs, were often more engaged and had a stronger civic voice (GNOCDC 2010c).

Figure 4-20. Civic Engagement Percent Indicator

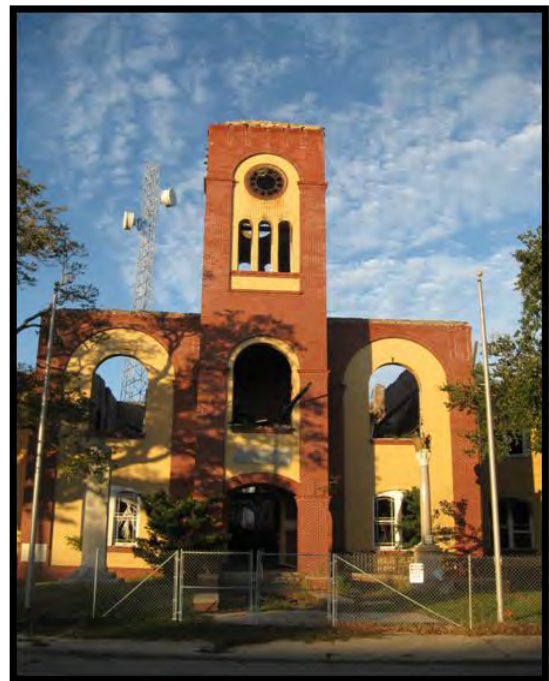


Source: Reproduced from GNOCDC 2010c

Photograph 4-18 shows what is left of the historic East Pointe a la Hache courthouse, which was severely damaged by both Katrina and arson prior to Katrina. This structure was an anchor for the community and, due to the lack of returning population, will probably not be replaced. A number of Federal, state, and local organizations, businesses, schools, religious and other non-profit organizations, and other institutions have participated in the recovery of the region, following the 2005 storms. In many ways this is a reflection of the strong social bond, community cohesion, and regional and National fiscal support.

Healthcare

Post-Hurricane Katrina healthcare recovery was discussed by Dr. Marcia Brand, Associate Administrator with the U.S. Department of Health and Human Services, on December 3, 2009, in a statement to the U.S. House of Representatives, Committee on Oversight and Government Reform (U.S. Department of Health and Human Services 2009) and is discussed below.



Photograph 4-18. Severely damaged East Pointe a la Hache Courthouse.

The Health Resources and Services Administration helps U.S. residents receive quality health care without regard to their ability to pay. To help fulfill this mandate in 2007 the Center for Medicare and Medicaid Services awarded the State of Louisiana the Primary Care Access and Stabilization Grant, a 3-year grant of \$100 million to assist public and nonprofit clinics in the greater New Orleans area. This grant was to aid in expanding access to primary care, including primary mental health care, to all residents, including low-income and uninsured residents within Jefferson, Orleans, Plaquemines, and St. Bernard parishes. The Louisiana Department of Health and Hospitals (LDHH) made provisions with the Louisiana Public Health Institute to help the state administer and oversee this grant's day-to-day operations. As of September 30, 2009, a total of approximately \$61 million has been disbursed with an additional \$15.02 million projected to be allocated in December 2009, to 25 sub-awardees through the Louisiana Public Health Institute. The organizations receiving the grant funds operate 91 primary and behavioral health care sites across the region, including fixed and mobile facilities. About 56 percent are primary care centers, 30 percent are behavioral health sites, and 14 provide a combination of services. Fourteen percent of these locations are mobile sites, and 86 percent are fixed sites (U.S. Department of Health and Human Services 2009). Approximately \$4 million of Primary Care Access and Stabilization Grant funding was specifically allocated to the City of New Orleans Health Department to increase clinical services, recruit health professionals for two new public health care sites, and staff dental and vision care mobile vans (U.S. Department of Health and Human Services 2009).

Additionally in February 2009, through the American Reinvestment and Recovery Act, the New Orleans area received \$7.4 million that allowed health centers to provide primary care services to an additional 35,000 patients at more than 20 clinics (U.S. Department of Health and Human Services 2009).

Currently, 87 community-based health centers operate across Orleans, Jefferson, Plaquemines, and St. Bernard parishes in Louisiana. GNOCCommunity.org is "a service dedicated to helping individuals find a quality healthcare center that fits their needs." The website is searchable by zip code or type of health service sought. The centers are open to all people "regardless of their ability to pay" and are funded in part by the Primary Care Access and Stabilization Grant grants discussed above, which expired at the end of September 2010 (Health Affairs 2010).

St. Charles Parish

Three hospitals are currently in operation in St. Charles Parish, and all are located in Luling, Louisiana:

- One acute care hospital - St. Charles Parish Hospital
- Two rehabilitation hospitals
 - Specialty Rehabilitation Hospital of Luling
 - St. Charles Specialty Rehabilitation Hospital LLC

In January 2010, the LDHH community-based rural health grant program provided \$75,000 to the St. Charles Community Health Center's core site located in Luling to expand existing oral health services in St. Charles Parish. As St. Charles Parish is considered a dental health provider shortage area, the funds will be used to hire, train, and employ additional dental department personnel, including a hygienist and an additional support staff member (LDHH 2010).

Jefferson and Orleans Parish

Numerous health care facilities are in operation in Jefferson and Orleans parishes, and provide the primary medical services to the metropolitan area. These include:

- Touro Infirmary, New Orleans
- Ochsner Baptist Hospital, New Orleans

- Children's Hospital of New Orleans
- Tulane University Medical Center, New Orleans
- LSU Medical Center, New Orleans
- East Jefferson General Hospital, Metairie
- West Jefferson Medical Center, Marrero
- Ochsner Medical Center, Kenner
- Ochsner Medical Center West Bank, Gretna
- Ochsner Foundation Hospital, Jefferson
- Tulane Lakeside Hospital, Metairie

Although no final determination has been made regarding the disposition of the Charity Hospital building, the LSU Medical System has determined that it is not suitable to return to use as a hospital. LSU is planning a new medical complex in association with a new Veterans Administration hospital just north of the Central Business District in the City of New Orleans (Barrow 2010a). A recent proposal by a group of top real estate executives seeks to use the Charity Hospital site as a replacement for the current City Hall. Due to a long list of bureaucratic problems and delays, the governing board of the University Medical Center Hospital Corporation met officially for the first time on August 25, 2010, although the new complex is projected to be fully open no later than the end of 2014 (Barrow 2010).

The new 34-acre Veteran's Administration hospital complex to replace the one damaged during Hurricane Katrina is planned to be a 200-bed medical center and is near the present Tulane Medical Center. Work on the complex started in late fall of 2011 and it is slated to open in 2014 (*Times-Picayune* 2011).

A new heliport is being constructed for Tulane Medical Center. When the levees were breached after Hurricane Katrina, Tulane Medical Center turned the top level of its hospital parking garage into a temporary evacuation zone. This space was used to airlift hundreds of patients, medical staff, and others to safety. The new heliport will be used to speed up future evacuations, but will also have an immediate benefit of the expansion of Tulane's patient base beyond the city (Barrow 2010b).

The Federal government has offered financial support for approximately 90 primary care clinics in the Greater New Orleans Metropolitan Area, and has approved the State of Louisiana's request to steer \$30 million in unspent hurricane recovery grants to the health network that is credited with expanding primary care access to tens of thousands of uninsured and underinsured households (Barrow 2010c). Additionally, in October 2010, the LSU (Health Care Services Division) Medical Center of Louisiana at New Orleans was provided with additional FEMA funding of approximately \$4.8 million for building repair and replacement (FEMA 2010).

St. Bernard Parish

As of September 2010, no medical centers had opened in St. Bernard Parish or elsewhere east of the IHNC in the Ninth Ward of New Orleans. Board members for the new St. Bernard Parish hospital are deciding where to build the planned 40-bed facility. In April of 2010, the parish's hospital board secured a site on land donated by the Arlene and Joseph Meraux Charitable Foundation, but the project has not started construction (Kirkham 2010a). The plan was originally to complete the hospital by the end of 2011; however, no new dates of completion have been provided (Kirkham 2010b).

Prior to Katrina, there were seven ambulances available to the Emergency Medical Service. Ambulance service is currently provided by contracted companies and accessed through available 911 service.

Plaquemines Parish

Plaquemines Parish residents now have access to a large number of medical facilities located in the region, including the University Hospital in New Orleans, one of the largest teaching hospitals in the country, as well as the clinics of LSU and Tulane Schools of Medicine, the Ochsner Foundation Hospital and Clinics, and numerous other public and private medical facilities. Meadowcrest and West Jefferson hospitals are also in close proximity to the west bank of Plaquemines Parish (PlaqueminesParish.com 2010).

In Port Sulphur, the Plaquemines Medical Center provides emergency medical services to children and adults, along with basic diagnostic services and home health care treatment. This facility is staffed by a physician with nursing and support personnel 24 hours a day, 7 days a week (PlaqueminesParish.com 2010).

Schools

Four of the five project area parishes (Jefferson, Orleans, Plaquemines, and St. Bernard) saw large drops in their school enrollment figures after Katrina, while St. Charles Parish experienced slight increases in the number of students after the storm as shown in table 4-45. This is due in part because St. Charles was farther away from the storm's center as it passed overhead, and there was little flooding from levee failure.

Table 4-45. Public School Enrollment by Parish (2000-2010)

School Year		St. Charles	Jefferson	Orleans	Plaquemines	St. Bernard
2000-2001		9,984	51,110	78,041	4,989	8,588
2001-2002		9,947	50,915	73,724	4,933	8,635
2002-2003		9,807	51,669	71,212	5,475	8,775
2003-2004		9,757	51,675	69,051	5,823	8,950
2004-2005		9,797	51,666	66,372	5,952	8,872
2005-2006	Jan	9,945	41,750	6,242	3,563	955
	Feb	9,885	42,240	9,298	3,623	1,670
	Mar	9,846	42,339	10,222	3,664	1,940
	Apr	9,775	42,777	10,816	3,721	2,268
	May	9,761	42,685	12,103	3,762	2,337
2006-2007	Oct	9,734	43,617	25,651	4,374	3,536
	Feb	9,653	43,683	26,165	4,411	3,764
2007-2008	Oct	9,639	44,058	32,149	4,496	4,198
	Feb	9,547	43,602	32,887	4,472	4,229

Table 4-45, continued

School Year		St. Charles	Jefferson	Orleans	Plaquemines	St. Bernard
2008-2009	Oct	9,606	44,018	35,955	4,521	4,684
	Feb	9,556	43,979	35,976	4,451	4,798
2009-2010	Oct	9,706	45,076	38,051	4,698	5,298

Source: Louisiana Department of Education. *LEA and School-Level: Public Student Counts and Percentages, Multi-Stats By LEA 2000-2009*. Downloaded from www.doe.state.la.us/lde/pair/1489.html. From a compilation by the GNO Community Data Center. <www.gnocdc.org>

Note: Orleans schools include charter and non-charter schools overseen by the Recovery School District, the Orleans Parish School Board, also known as New Orleans Public School Board and the Board of Elementary and Secondary Education

St. Charles Parish

Although St. Charles Parish public school enrollment increased immediately post-Hurricane Katrina, enrollment in 2010 (9,706 students) was virtually the same as it was in 2004 (9,721 students) (Scallan 2010).

Based upon data from the Louisiana Department of Education, public schools in St. Charles Parish have improved performance scores from 104.9 in 2009 to 105.5 in 2010, and the district was ranked 10th in Louisiana in 2010 (Boquet 2010).

Jefferson Parish

Jefferson Parish was less affected by Hurricane Katrina in 2005 and rebounded at a more rapid pace than neighboring Orleans Parish. By 2010, 88 schools were located on the east and west banks of Jefferson Parish with a total enrollment of 44,844 students (Jefferson Parish Public School System 2010). In October 2009, the release of annual school performance scores by the state revealed that Jefferson Parish's public school system posted its largest-ever increase in their performance score, to 78.4, though the performance score remains significantly below the state average of 91 (*Times-Picayune* 2009a).

As a part of the storm reconstruction, a new Terrytown Elementary School was built. The Administration Building and Thomas Jefferson Senior High School were also completely renovated, and the roofs at Woodmere Elementary were upgraded to withstand hurricane-force winds (Capochino 2005a).

Orleans Parish

One of the most dramatic changes that New Orleans has experienced since Hurricane Katrina is the public school system. The governance structure of the school system has been completely reorganized, which allowed some schools to be governed under the direction of the locally elected Orleans Parish School Board, while others are governed by the state-run RSD, and the remaining schools operate as independent charter schools. The Orleans Parish School Board currently has six District-run schools and 12 charter schools. The RSD operates 66 schools, of which 50 are charter schools.

Collectively, the performance of the schools has improved dramatically, though as a whole, New Orleans' schools still perform below the statewide levels. Post-Hurricane Katrina, after decades of underperformance, the average performance score of New Orleans Public Schools has risen to 70.6 (*Times-Picayune* 2009a). While enrollment since Katrina is smaller, this has created an opportunity to reimagine the physical profile of the school system as well. The New Orleans

public schools have embarked on a \$1.8 billion capital campaign initiative over the next 10 years (GCR 2010).

In October 2010, the following educational projects were provided with additional FEMA funding:

- Archdiocese of New Orleans: Approximately \$2.4 million for school-related projects.
- Holy Cross School: More than \$4.4 million for repairs.
- Xavier University of Louisiana: More than \$7.8 million has been obligated to replace its gymnasium (FEMA 2010).

St. Bernard Parish

As of September 2010 and as shown in table 4-46, there are 10 schools, public and private, that are operational and serving the people of St. Bernard Parish. Currently, there are bids out for the repairs of three more: Lacoste Elementary, the Maumus Center, and Sebastien Roy Elementary School (Sherwood 2009).

Table 4-46. Status of Schools in St. Bernard Parish as of September 2010

School	Grade	Status
Andrew Jackson Elementary School	Pre-K to 5th	Open
Davies Elementary School	Pre-K to 5th	Open
J.F. Gauthier Elementary School	Pre-K to 5th	Open
Lacoste Elementary	Pre-K to 5th	Undergoing Repairs
Maumus Center	Pre-K to 5th	Undergoing Repairs
Sebastien Roy Elementary School	Pre-K to 5th	Bids Out For Repairs
W. Smith Elementary School	Pre-K to 5th	Open
St. Bernard Middle School	7th to 8th	Open
N.P. Trist Middle School	6th to 8th	Open
Chalmette High School	9th to 12th	Open
C.F. Rowley Alternative (formerly Nova Academy)	6th to 12th	Open
Chalmette Christian Academy	Pre-K to 8th	Open
Our Lady of Prompt Succor	Pre-K to 8th	Open

Source: Sherwood 2009

Inundated with 9 ft of water and battered by flying debris, the W. Smith Elementary School was destroyed during the 2005 hurricane season. Through FEMA funding provided in late 2009, the school is scheduled for replacement. Additionally, other FEMA funds provided at this same time are slated to replace various school materials, including publications, information technology, furniture, school equipment, and other supplies, for the St. Bernard Parish school system (Melancon 2009).

Plaquemines Parish

Prior to Katrina there were 14 public schools in Plaquemines Parish. By late 2006, seven of these schools were reopened. Although progress is being made, there are still only eight public schools open within the parish, including three high schools, one middle school, three primary schools, and one school for middle and high school children with special needs. These schools are listed below (PPSB 2010b):

- Belle Chasse High School
- South Plaquemines High School
- Phoenix High School
- Belle Chasse Middle School
- Belle Chasse Primary School
- Boothville-Venice Elementary School
- South Plaquemines Elementary School
- Plaquemines Parish Alternative School

Although the following schools are currently open, these schools suffered severe damage from the storms and are undergoing renovations, remodeling, and additions. All of the schools listed below are operating at the existing facilities except for the Phoenix High School and South Plaquemines Elementary and High schools. The following schools will be refurbished or replaced and are either in the design phase or currently under construction (PPSB 2010b):

- Belle Chasse Primary School
- Belle Chasse Middle School
- Phoenix High School
- South Plaquemines Elementary School
- South Plaquemines High School

The Port Sulphur High School (not listed above) was destroyed by Katrina and was demolished in 2010. Through FEMA funding, a new elementary school will be built at the site in the future (FEMA 2007a). In addition, a replacement for the current Plaquemines Parish Alternative School, which will be known as the PPSB Learning Center, is also in the design phase (PPSB 2010b).

Further assistance on the rebuilding effort for the Plaquemines Parish schools was provided in October 2010, when the Plaquemines Parish School Board was provided with additional FEMA funding of more than \$5.7 million for school-related recovery projects (FEMA 2010).

Police Protection

All parishes provided information on their current operating status except Jefferson Parish. Therefore, Jefferson Parish is not listed under this parish recovery section.

St. Charles Parish

Except for the initial post-disaster contingent, there were never any residual supplemental police forces, such as the U.S. Army, the National Guard, or the Louisiana State Police, needed in St. Charles Parish. The St. Charles Sheriff's Department was one of the first agencies opened to allow residents to return to the affected areas. They were also able to offer assistance to parishes that were severely affected (Robicheaux 2009).

St. Charles Parish has two districts, one on the east bank of the Mississippi River and one on the west bank, which together employ 370 full-time personnel, both officers and civilians (Robicheaux 2009). Under the 911 Call Center, there are four operators and one supervisor per 12-hour shift, and there are 16 officers and three supervisors in corrections per each 12-hour shift. Additionally, there are approximately 280 vehicles, including motorcycles, trucks, etc. This excludes watercraft, which can vary largely in number depending on need (Robicheaux 2009).

Orleans Parish

Orleans Parish receives police protection from the eight districts of the New Orleans Police Department. The First, Second, and Fourth districts are still housed in their pre-Hurricane

Katrina headquarters buildings at 501 N. Rampart Street, 4317 Magazine Street, and 1348 Richland Drive, respectively. The Third District, which includes the hard-hit Lakeview, Gentilly, and London Avenue suburbs, is now housed at 4650 Paris Avenue. Their old headquarters at 1700 Moss Street has been demolished. The Fourth District is located on the West Bank of the Mississippi River and consists of Algiers, English Turn, and other areas on the West Bank extending downriver. Other than extensive wind-damage and some localized flooding, this area survived Katrina relatively well (Williams 2009a). In contrast, directly across the Mississippi River, the Fifth District Station and Substation sustained major damage from Hurricane Katrina and, after moving several times to temporary facilities, are now located at 3900 N. Claiborne Avenue (Williams 2009a).

Today, the total force in the New Orleans Police Department comprises over 1,650 individuals on active duty. Until recently, the police force worked in 12-hour shifts. It now works in three 8.5-hour shifts (Williams 2009a). Additionally, there are over 600 marked police vehicles, of which 435 are squad cars. Additional vehicles consist of unmarked cars, SUVs, and motorcycles (Williams 2009a).

St. Bernard Parish

The Sheriff's Office, after a period of time in which its administrative and enforcement offices were housed in trailers at the Port of St. Bernard, has moved back into many of its pre-Hurricane Katrina buildings. The department has reintroduced virtually all services available before the storm (Cannizaro 2010).

Administrative offices, as well as the offices of its Civil and Tax divisions, are now housed in the Sidney Torres Plaza/Regions Bank Building at 8301 West Judge Perez Drive. A new office building is under construction at its old location at Courthouse Square in Chalmette.

The Sheriff's Office has reopened most of the parish sub-stations, reopened the Parish Prison and Juvenile Detention Center, reintroduced the D.A.R.E. anti-drug program for children in schools, restarted the Citizens Police Academy for residents to better understand law enforcement, restarted the Neighborhood Watch program, and again celebrates the National Night Out Against Crime (Cannizaro 2010).

While the population of the parish has dropped, there are new problems due to an influx of residents who moved to St. Bernard after the hurricane, some because they were displaced from other parishes by the storm and some as a result of the ongoing recovery work in the parish (Cannizaro 2010). As of 2010, the department answers 3,000 calls a month for assistance from the public and is making approximately 300 arrests a month, focusing on narcotics activity, personal and property crimes, and traffic enforcement, including impaired driving (Cannizaro 2010). As reported by the Sheriff's Office, many neighborhoods have repopulation on some streets while having vacated properties on others. Per Officer Cannizaro, this results in fewer residents to act as "the eyes" of the department to see and report suspicious characters and activity, making it more important for sheriff's deputies to be vigilant (Cannizaro 2010).

Plaquemines Parish

Currently, the Sheriff's Office has a staff of 204 full-time employees and three part-time, and the three patrol districts are currently fully staffed. All shifts are 12-hour shifts and are the same shift patterns that were in use prior to Hurricane Katrina. Due to the Post-Hurricane Katrina population shift in the parish, the number of deputies in District 2 is currently four deputies less than pre-Hurricane Katrina, while the number in the 1st District has increased by a total of eight deputies. The station facilities for Districts 2 and 3 are currently housed in temporary trailers.

There are a total of 60 patrol deputies, including deputies who are currently in training. There are no residual supplemental forces in service. These numbers do not include deputies who are

assigned to specialized units, such as Criminal Investigations and Narcotics, Crime Prevention, Marine Patrol, Aviation Unit, and multi-jurisdictional task forces. There are approximately 62 marked patrol cars within the fleet.

Prior to Katrina, the Sheriff's Office operated an 815-person Detention Center located near the community of Davant on the east bank of the parish. The Detention Center sustained catastrophic wind damage and was submerged in over 17 ft of water, resulting in the total loss of the facility. Since Katrina, prisoners have been held at the Belle Chasse Lock-up and in correctional facilities in the Metro New Orleans area. The Plaquemines Parish correctional facility is still awaiting final approval from FEMA to start the rebuilding process, and prisoners continue to be held at the Jefferson Parish Correctional Center.

A much-needed infusion of funds was received in October 2010 when the Plaquemines Parish Sheriff's Office was granted additional FEMA funding of more than \$36.7 million for criminal justice facilities (FEMA 2010).

Fire Protection

Jefferson Parish

The Jefferson Parish fire departments are at or near full operational status. Although the West Bank was less damaged than the East Bank, they were back to 100 percent operations 6 to 7 months after the hurricane.

Orleans Parish

As of the fall of 2011, there are 36 fire stations in Orleans Parish that are divided into six Districts. The New Orleans Fire Department operates a total of 35 engines, 10 ladders, two rescues, one Haz-Mat unit, and numerous other special, support, and reserve units (City of New Orleans 2010b). The St. Claude/Florida Avenue Station is housed at its pre-Hurricane Katrina location, but within a trailer with Engine No. 8 and a water truck operating out of this location. Six years after Hurricane Katrina, three engine companies are still out of service in Orleans Parish and, although operating, five stations still require work to be done (WWLTV.com 2011). The Lower Ninth Ward Station Engine No. 22 is located at 2041 Egan Street. Engine No. 39 is located in the Holy Cross Station, which was moved from their damaged headquarters on 6030 St. Claude Avenue to the corner of North Claiborne Avenue and Caffin Avenue, across from the reopened Martin Luther King Elementary School (City of New Orleans 2010b).

St. Bernard Parish

Work on the fire stations has continued steadily with FEMA funding. Of the 10 fire stations in St. Bernard Parish, seven are new or newly renovated, while the remaining three stations are still providing service in temporary quarters (St. Bernard Parish Government 2010). Most of the newly constructed stations were built to minimize damage from storms – they have elevated sleeping quarters and first floors are designed to be easily cleaned after a storm. The following are being built as new construction and include (St. Bernard Parish Government 2010):

- Arabi: Station 2 construction is complete
- Chalmette: Station 3 is completed and Station 5 construction started in mid-January 2009 and is ongoing
- Meraux: Station 6 is still under construction
- Violet: Station 7 is complete
- Poydras: Station 8 is under construction
- Verrett: Station 10 construction is complete
- Yscloskey: Station 11 complete as of April 2010
- Delacroix Island: Station 12 construction is complete as of April 2010

Plaquemines Parish

There are still divisions within the Plaquemines Parish Fire Department that are being housed in alternate headquarters while either existing structures are being repaired or new buildings are being erected. Until early August 2010, the firefighting equipment for the Buras Fire Department was being sheltered in the remains of a severely damaged store building with a new roof but open to the elements on three sides (photograph 4-19). However, by August 26, 2010, the new headquarters located a few blocks north of the temporary shelter was completed (photograph 4-20). The station was completely rebuilt after Hurricane Katrina and is the third of six newly built fire stations to open since 2009 (Sercovich 2010).



Photograph 4-19. Buras Volunteer Fire Department temporary headquarters.



Photograph 4-20. New headquarters for Buras Fire Department.

Plaquemines Parish also recently received four brand new fire vehicles and ordered nine new fire vehicles, paid for by FEMA. As of August 2010, seven of the nine had been delivered (Sercovich 2010). Additionally, the fire station in Port Sulphur has recently opened their new building.

4.2.15.1.1 Environmental Justice

Environmental Justice has been defined as the fair treatment of all people regardless of race, color, National origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Evaluation of Environmental Justice concerns is required by EO 12898. The DoD strategy and goal on Environmental Justice states the following:

“DoD will integrate the President's policy on Environmental Justice into its mission by ensuring that its programs, policies, and activities with potential disproportionately high and adverse human health or environmental effects on minority and low-income populations are identified and addressed. Affected communities will be partners in the process to address these concerns; together, we will build a foundation that reflects an awareness and understanding of Environmental Justice issues. In addition, DoD will annually evaluate progress in implementing and maintaining compliance with the provisions of the Executive Order.”

The USACE undertook environmental justice analysis for most of the HSDRRS Proposed Actions in accordance with the requirements of EO 12898 and the DoD's *Strategy on Environmental Justice*, dated March 24, 1995. The USACE identified and addressed any disproportionately high and adverse human health or environmental effects of the HSDRRS projects on minority and low-income populations. To accomplish this, the USACE identified

low-income and minority populations within each project area. When appropriate and as needed, community outreach activities such as Environmental Justice stakeholder meetings were held. The following demographic data sources were used (as applicable) in each Environmental Justice analysis performed:

- U.S. Census 2000
- U.S. Census American Community Survey 2006
- Greater New Orleans Community Data Center 2000 and 2007
- LDHH 2006
- Claritas 2007
- Environmental Systems Research Institute (ESRI) 2007 and 2012
- Rand Corporation 2005, 2006, and 2008

The two demographic data sources utilized most frequently in Environmental Justice analysis within the HSDRRS project area were the U.S. Census 2000 and ESRI 2007. Each IER (and IER Supplemental) Environmental Justice analysis utilized Census Block Group level statistics from the 2000 Census and 2000 and 2007 ESRI. Table 4-47 illustrates the minority and low-income values and their corresponding percentages for each of the five parishes in the HSDRRS project area. The State of Louisiana’s minority and low-income populations were used as well for comparison and as benchmarks. Limited information at the Block Group level existed for ESRI 2007 data.

Table 4-47. Minority and Low-Income Environmental Justice Indicators by the HSDRRS Parish

Region	Environmental Justice Indicator							
	Minority Population, 2000		Estimated Minority Population, 2010		Persons Living Below Poverty Line, 2000		Estimated Persons Living Below Poverty, 2006-2010	
	Number	Percent	Number	Percent	Number	Percent	Number*	Percent
Louisiana	1,689,422	37.5	1,798,488	39.7	851,113	19.6	780,359	18.1
St. Charles Parish	14,171	29.5	17,855	33.8	5,424	11.4	6,458	12.5
Jefferson Parish	160,643	34.6	190,284	44.0	22,268	12.6	60,756	14.2
Orleans Parish	355,803	73.4	239,059	69.5	130,896	27.9	69,685	24.4
St. Bernard Parish	10,804	15.6	11,290	31.5	8,687	13.1	4,134	15.0
Plaquemines Parish	8,345	31.2	7,425	32.2	4,682	18.0	2,611	11.6

*Number for whom poverty status is determined. Note that this number is not comparable to the number living below the poverty line in 2000.

The following information provides Environmental Justice existing conditions for the parish where the specific HSDRRS work would occur, as well as Environmental Justice details for the affected communities adjacent to or near each IER (and IER Supplemental) HSDRRS project area.

St. Charles Parish

The St. Charles Parish minority population increased from 2000 to 2010, from approximately 30 percent in 2000 to 34 percent in the 2010. This followed the increasing minority population trend of the overall state percentages, but the increase in minorities in St. Charles Parish was a more substantial increase than elsewhere in the state (see table 4-47). Additionally, the St. Charles Parish poverty indicator percentages also increased slightly from 2000 to the 2010 estimate, from approximately 11 percent to 12 percent, an increasing trend also reflected by the state's low-income population for the same time period. Overall, the racial and ethnic makeup of St. Charles Parish is predominantly white, with a substantial African American population and, to a lesser extent, a population of Hispanic descent.

Table 4-48. Minority and Low-Income Communities Adjacent to the HSDRRS Within the Project Area

IER ¹ #	Minority Population (2000)	Estimated Minority Population (2007)	Persons Living Below Poverty Line (2000)	Estimated Households Living Below Poverty (2007)
<i>St. Charles Parish</i>				
1/S 1	No	Yes***	Yes	Yes**
2/S 2 and 16/S 16.a	No	No	No	No
<i>Jefferson Parish</i>				
3/S 3.a and 15	No	No	No	No
14/S 14.a	No	Yes	No	No
17	No	No	No	No
18 Churchill Farms Site	Yes	Yes	No	No
18 Westbank Site G Site	No	Yes	No	No
19 River Birch Phase 1 and Phase 2 Sites	Yes	Yes	Yes	Yes
22* West Bank Site F	East –No West- Yes	Yes	No	No
22 West Bank Site I	No	No	No	No
25 Westbank Site E Phase I and 2 Sites and Westbank Site D	Yes	Yes	Yes	Yes
26 South Kenner Road Site	Yes	Yes	Yes	Yes
26 Willwood Site	No	No	No	No
31 River Birch Expansion	Yes	Yes	Yes	Yes
<i>Orleans Parish</i>				
4**	No	No	No	No
5	Yes	Yes	Yes	Yes
6/S 6	Yes	Yes	No	No
7/S 7	Yes	Yes	No	No
11 Tier 2 Pontchartrain	Yes	Yes	Yes	Yes
11/S 11 Tier 2 Borgne	No	No	No	No

Table 4-48, continued

IER ¹ #	Minority Population (2000)	Estimated Minority Population (2007)	Persons Living Below Poverty Line (2000)	Estimated Households Living Below Poverty (2007)
27	Yes	Yes	Yes	Yes
18 (Maynard Site)	No	No	No	No
18 Cummings North Site	Yes	Yes	No	No
19 (Eastover Site)	Yes	Yes	No	No
25 (Stumpf Site)	Yes	Yes	Yes	Yes
29 (Eastover II Site)	Yes	Yes	No	No
<i>Plaquemines Parish</i>				
12/S 12	Yes	Yes	No	No
13	Yes	Yes	Yes	Yes
17	No	Yes	No	Yes
18 Belle Chasse Site	No	No	No	No
22 West Bank Site N	No	No	No	No
<i>St. Bernard Parish</i>				
8	No	No	No	No
9**	No	Yes	No	Yes
10**	No	No	No	No
18 1418/1420 Bayou Road and 1572 Bayou Road Sites	No	No	No	No
18** 910 Bayou Road Site	No	No	Yes	Yes
18 Dockville Site	No	No	No	No
19 Sylvia Guillot Site	No	No	No	No
19 Gatien – Navy Camp Hope Site	Yes	Yes	Yes	Yes
19 DK Aggregates Site	No	Yes	Yes	Yes
28 (Crovetto Site)	No	No	No	No
31 (Spoil Area Site)	No	No	No	No

*Community east of project area in 2000 was not a minority community but west of project area in 2000 was a minority community

**See discussion on adjacent communities

*** Data from ESRI 2010 estimates (not found in the IER)

1 - Supplemental

Jefferson Parish

In Jefferson Parish, the minority population increased from 2000 to 2010 with the percentages of minorities in the parish population rising from approximately 35 percent to 44 percent (see table 4-47). Low-income populations in Jefferson Parish have also increased from 2000 to 2010, increasing 13 percent to 14 percent, respectively. During that time period, the state’s

percentages decreased from almost 20 percent in 2000 to approximately 18 percent for the 2010 estimate.

Orleans Parish

The Orleans Parish minority population decreased from 2000 to 2010, ranging from approximately 73 percent in 2000 to 70 percent in the 2010 estimate. This is not a trend echoed in the overall state percentages (see table 4-47). The Orleans Parish poverty indicator percentages decreased from 2000 to the 2010 estimate from approximately 28 percent to 24 percent.

St. Bernard Parish

The St. Bernard Parish minority population had a large increase from 2000 to 2010, ranging from approximately 16 percent in 2000 to 31 percent in the 2010 estimates (see table 4-47). Poverty indicators for St. Bernard Parish show a slight increase, with the 2000 levels at 13 percent rising to approximately 15 percent in the 2010 estimate. The significant increase in minority populations from 2000 to 2010 is likely due to a change in demographics caused by the displacement of households after Hurricane Katrina.

Plaquemines Parish

The minority population in Plaquemines Parish increased slightly from approximately 31 percent to 32 percent between 2000 and 2010 (see table 4-47). The percentage of persons living in poverty decreased from 18 percent in 2000 to approximately 12 percent in 2010 (see table 4-47).

Table 4-49 indicates those communities adjacent to the HSDRRS that are considered to be minority or low-income communities with Environmental Justice concerns. If the IERs did not provide ESRI 2007 information for estimates of adjacent minority populations then data were utilized from ESRI 2010 Louisiana estimates as noted in table 4-49 (ESRI 2010). Those communities in which a specific Environmental Justice concern exists or an Environmental Justice consideration was necessary are discussed after the table.

Table 4-49. Minority and Low-Income Communities Adjacent to the HSDRRS Actions Outside of the Project Area

IER #	Minority Population (2000)	Estimated Minority Population (2007)	Persons Living Below Poverty Line (2000)	Estimated Households Earning < \$15,000/year (2007)
<i>Ascension Parish</i>				
32 (Bocage Plantation Site)	Yes	Yes	No	Yes
<i>East Baton Rouge Parish</i>				
31(Lilly Bayou Site)	No	No	No	No
<i>Iberville Parish</i>				
19 (St. Gabriel Redevelopment Site)	Yes	Yes	No	Yes
<i>Lafourche Parish</i>				
31 (Raceland Raw Sugars Site)	No	Yes**	No	No
<i>Plaquemines Parish</i>				
18 (Triumph Site)	No	No	No	No
19 (Kimble #2)	Yes	Yes	Yes	Yes
22 (Brad Buras Site)	No	No	Yes	Yes
22 (Tabony Site)	Yes	Yes	Yes	Yes
23* (Myrtle Grove Site)	Yes	No	Yes	No
25 (Tac Carrere Site)	No	No	Yes	Yes
26 (Meyers Property Site)	No	No	No	No

Table 4-49, continued

IER #	Minority Population (2000)	Estimated Minority Population (2007)	Persons Living Below Poverty Line (2000)	Estimated Households Earning < \$15,000/year (2007)
29 (Bazile Site)	No	No	No	No
31 (Idlewilde Stage 2)	Yes	Yes	Yes	Yes
31 (Scarsdale Site)	No	Yes**	No	No
32 (Citrus Lands)	No	No	No	No
32 (Conoco Philips Site)	No	No	No	No
32 (Idlewilde Stage 1)	No	No	No	No
32 (Nairn Site)	No	No	Yes	Yes
32 (Plaquemines Dirt and Clay Site)	No	No	No	No
<i>St. Bernard Parish</i>				
18 (4001 Florissant Site)	No	Yes	Yes	Yes
23 (Acosta and 1025 Florissant Sites)	No	No	No	No
31(Acosta 2 Site)	No	No**	Yes	No
<i>St. Charles Parish</i>				
18	No	No	No	No
23 and 32	Yes	Yes	Yes	Yes
<i>St. James Parish</i>				
30 (Big Shake Site)	Yes	Yes	No	No
<i>St. John the Baptist</i>				
26 (Willow Bend)	No	No	No	No
29 (Willow Bend II)	Yes	Yes	Yes	Yes
<i>St. Tammany Parish</i>				
29 (Tammany Holding Area)	No	No	No	No
31 (Levis Site)	No	Yes**	No	No
<i>Hancock County, MS</i>				
19 (Pearlington Dirt Phase 1)	No	No	No	No
23 (Pearlington Dirt Surface Mine Site)	No	No	No	No
26 (Frierson Site)	No	No	No	No
30 (Henley Site)	No	No	No	No
31 (Kings Mine Site)	No	No	No	No
31 (Port Bienville Site)	No	No	No	No

*See discussion on adjacent communities

**Data from ESRI 2010 estimates (not found in the IER)

IER #1 and IER Supplemental #1 (St. Charles Parish)

The HSDRRS action described in IER #1 is located on the east bank of the Mississippi River. It should be recognized that substantial low-income and minority groups reside in the parish, particularly in communities along the Mississippi River. The project area, which could potentially affect minorities and low-income individuals, includes several Census-Designated Places (i.e., Norco, New Sarpy, Destrehan, and St. Rose [see appendix D, Location Maps 1 and 2]) and census block groups. The largest census block group near the project corridor does not have a population because it encompasses mostly marshland and part of the Shell Chemical industrial complex. However, the nearby towns of Destrehan, New Sarpy, Norco, and St. Rose all had minority populations in 2000, and 2010 estimates indicate that this has not changed. New Sarpy and St. Rose also had a high number of families living below the poverty line in 2000.

IER #4 (Orleans Parish)

Communities located adjacent to the HSDRRS footprint described in IER #4 are not minority or low-income areas based on 2000 data and 2007 estimates. However, the project area detailed in IER #4 is near neighborhoods within the New Orleans East Bank areas that encompass Planning Districts 1 through 7 and include Gentilly, Lakeview, Mid City, Bywater, French Quarter/CBD, Central City/Garden District, and Uptown/Carrollton. According to 2000 USCB data, these neighborhoods contained census block groups that were considered low-income and minority communities (USCB 2012). The low-income and minority population decreased from 2000 to 2007, which was likely caused by the displacement of residents as a result of Hurricane Katrina; however, even with the decline in population, the demography of the larger New Orleans East Bank remains low-income and minority in character. Additionally, it is unlikely that this change will be permanent, as many of the displaced residents that intend to return are low-income and minority households. As long as state recovery efforts are successful in their mission of bringing back displaced families who wish to return, the current demographic and income profile of Orleans East Bank should shift closer to its pre-Hurricane Katrina profile.

IERs #9, #10, and #18 (St. Bernard Parish)

The HSDRRS project is located in the Caernarvon community of St. Bernard Parish. The 2000 USCB data indicated that the Caernarvon community was not a minority community; however, the 2007 data estimate that roughly 70 percent of its population is minority, and the percentage of households earning less than \$15,000 per year is greater than the parish and state percentages. However, the 2007 data overestimated the number of minority and low-income persons in the Caernarvon area, likely due to a large temporary trailer community (of approximately 100 trailers located between Lynn Oaks Drive and Jeanfreau Drive, off St. Bernard Parkway). Due to its status as a temporary shelter and because there is little to no evidence of new development within the Caernarvon area that would significantly alter its socioeconomic profile, it is likely that the current number of minorities is closer to the 2000 Census figures rather than the 2007 estimates. Therefore, despite the 2007 estimates, Caernarvon is likely not a minority community.

In an Environmental Justice stakeholder meeting held by the USACE on February 19, 2008, in Meraux (N. P. Trist Middle School, St. Bernard Parish), a meeting attendee expressed concern over “environmental injustice” due to the USACE projects impacting residents, as listed below:

- many residents are minorities (Spanish descent) with Spanish land grants
- rock dikes may close MRGO but will not protect these residents
- borrow areas will impact these residents

For these reasons, the HSDRRS area analyzed in IER #9 is considered by the USACE to be a community that could experience disproportionate project impacts.

The HSDRRS project detailed in IER #10 is also located in St. Bernard Parish. The 2000 Census data indicated that the parish was not a low-income or minority community; however, the 2007 estimates showed a change into a low-income and minority community. The 2007 data overestimated the number of minority and low-income persons in the St. Bernard Parish due to several FEMA trailer sites that were located within the parish. The temporary residents have moved into more permanent housing, and the demographic profile has likely shifted back towards its pre-Hurricane Katrina socioeconomic profile. St. Bernard is likely not a low-income or minority community. However, there are communities near the IER #10 action area that are low-income and/or minority communities, notably in the unincorporated areas of Violet and Poydras.

In IER #18, the 910 Bayou Road proposed borrow site is located adjacent to a residential area. According to USCB data, this area was a low-income, non-minority community in 2000, and 2007 estimates indicate that the minority and low-income population increased significantly from 2000 to 2007. The significant increase in minority population from 2000 to 2007 is likely due to the temporary change in demographics caused by the displacement of households after Hurricane Katrina. As temporary residents have moved into more permanent housing, the demographic profile has likely shifted towards its pre-Hurricane Katrina figures. The 910 Bayou Road area is classified as a low-income and non-minority community.

IERs Outside of the HSDRRS Project Area

The following HSDRRS IER borrow project work was located outside of the five-parish HSDRRS region. Table 4-49 indicates those communities adjacent to the HSDRRS borrow sites considered to be minority or low-income communities. If the IERs did not provide ESRI 2007 information for estimates of adjacent minority populations, then data were utilized from ESRI 2010 Louisiana estimates (ESRI 2010).

Plaquemines Parish (IER #23)

The HSDRRS Myrtle Grove borrow site described in IER #23 is near Myrtle Grove, which in 2000 had a total population of 1,131. Within this population, the majority of the residents were minority, with most of these residents being either African American or Native American/Alaska Native. The area has been developed as the Myrtle Grove Marina Estates, a higher end, waterfront residential development taking advantage of water access to inland lakes and bays through the Myrtle Grove Marina. Because the development occurred in the past few years, the census data may not reflect this change in demographics. The larger nearby area is a low-income and minority community, while the adjacent community of Myrtle Grove is likely not a low-income or minority community.

4.2.15.2 Impacts of HSDRRS

4.2.15.2.1 HSDRRS 2011 Impacts

The socioeconomic impact from the HSDRRS is primarily beneficial. No permanent adverse impacts on population and housing, business and industry, employment and income, community and regional growth, or community cohesion occurred as a result of the HSDRRS. Additionally, no permanent disproportionate impacts occurred on any minority or low-income community from HSDRRS construction.

Socioeconomics

Population and Housing

Although the USACE attempted to limit new ROW acquisition for the HSDRRS improvements in certain reaches of the HSDRRS, increased ROW was necessary. These acquisitions removed private property from the property tax rolls, and had a minor impact on property tax revenues. However, many reaches of the HSDRRS are far from the more populated Orleans Parish, and especially in St. Charles, Jefferson, and Plaquemines parishes, much of the HSDRRS alignment is far from inhabited areas. The HSDRRS had short-term and long-term beneficial direct and indirect impacts on the project area's population and housing. With the 100-year level of risk reduction, the probability of residential damage and destruction from a storm event declined. The population of many of these neighborhoods, which were provided a greater level of risk reduction, is returning. Additionally, with the HSDRRS complete, all structures within the system achieved the levels of risk reduction necessary for sustaining the use of the NFIP. Continued eligibility for lower insurance premiums in the NFIP for properties within the project area would further encourage long-term investment of economic resources and aid in a strong and sustainable recovery of the population in the region.

In Jefferson Parish, the proposed West Bank Site F borrow site is located adjacent to minority, moderate to middle-income communities that are predominantly African American. The excavation of borrow, if utilized, would have direct short-term impacts on the community to the west of the site, with less than 200 ft between the site and private residences. The areas surrounding the borrow site would be impacted by noise emissions dust, and increased traffic congestion. These impacts would be expected to be moderate but temporary, lasting only as long as required to complete construction of the project.

In Plaquemines Parish, the borrow site known as the Bazile area, would have direct temporary impacts, such as increased noise emissions and traffic congestion during excavation at the borrow site. These impacts would be expected to be moderate but temporary, lasting only as long as required to complete construction of the project. As of July 2011, the Bazile borrow site was not utilized for the HSDRRS construction.

Outside of the HSDRRS project area, within St. Tammany Parish, the Tammany Holding Corporation borrow site had temporary direct adverse impacts on nearby communities' homes from borrow construction activities, which included air quality, noise, and increased traffic. These impacts would be expected to be moderate but temporary, lasting only as long as required to complete HSDRRS construction. The Tammany Holding borrow site was utilized for the HSDRRS construction.

Business and Industry, Employment and Income

The HSDRRS construction activities provided a temporary direct socioeconomic benefit through local spending and employment and will continue to do so through August 2014 when the majority of the HSDRRS construction will be completed. As is shown in appendix H, the award of over \$6.5 billion in construction contracts to date, and the expenditure of approximately \$14 billion in the region on the HSDRRS through August 2014 provides local and regional construction and material supply businesses opportunities to hire, grow, and create sustainable businesses in the area. Although this is short-term (approximately 8 years) spending on construction projects, these businesses that have benefited from the construction opportunities will likely continue to provide jobs and compete for future construction contracts in the region and nationwide.

In the longterm, providing 100-year level of risk reduction will allow FEMA NFIP certification of the 100-year level of risk reduction, providing an overall economic benefit to the community. No significant adverse impacts on mineral or fisheries production were identified. Forestry or agricultural products were not impacted from floodwall and levee construction. Temporary adverse impacts occurred during construction near areas where there were closures of navigation channels, roads and highways. Additionally, general overall traffic congestion during the HSDRRS construction occurred, affecting adjacent businesses and industry, although these adverse impacts were temporary in nature (no greater than 3 years). Businesses, industries, employment, and income throughout the region were severely impacted from Hurricane Katrina. The 100-year level of risk reduction provides a greater level of safety, ensuring long-term beneficial impacts on the businesses and industries within the project area, which in turn should reflect positively on employment and income in the future.

In Plaquemines Parish, the West Bank Site N borrow site, which was used for HSDRRS construction, potentially caused negligible temporary adverse construction impacts on neighboring communities along LA 23 due to traffic congestion. These traffic impacts caused an increase in noise levels and air emissions near the borrow site area. Also, in Plaquemines Parish, the Myrtle Grove and Tac Carrere borrow sites potentially caused negligible temporary adverse construction impacts on residents in the surrounding areas. None of these surrounding communities were low-income or minority communities; therefore, no Environmental Justice

issues occurred because of the borrow areas. However, businesses and industries within adjacent areas potentially suffered these same temporary adverse impacts due to traffic congestion. Outside of the HSDRRS, within St. Tammany Parish, direct adverse short-term impacts from borrow site activities such as fugitive dust emissions, and increased noise and traffic occurred within 1 mile of the Tammany Holding Corporation borrow site. This HSDRRS borrow action created two borrow areas with a combined area of 388 acres.

Per Capita Personal Income, Community and Regional Growth

Impacts of Hurricane Katrina included loss of life, destruction of homes and businesses, damage and disruption to public facilities and services, high unemployment, loss of income, and disruption and closure of local institutions. As was seen early in the recovery timeline, individuals and even whole neighborhoods and communities were unsure of the decision to return, which caused large decreases in community and regional growth. Although there has been an increase in per capita income, this has been at the expense of the working poor who often were unable to return to the project area. However, an equal reduced risk of flooding for all individuals residing within the HSDRRS is ensured, providing both short-term and long-term beneficial impacts on the project area's per capita personal income and community and regional growth.

Short-term (approximately 8 years) beneficial impacts on community and regional growth resulted from the HSDRRS construction projects. Approximately \$6.6 billion was contracted for HSDRRS construction to date (see appendix H). While many of the prime contractors are based outside the Region of Influence (ROI), many have established offices in the region. Impacts also result from the local subcontractors, laborers, equipment leased or purchased, housing, fuel, food, and the many other supplies required to support this massive construction effort. It is unknown whether businesses that have established local offices or moved to the New Orleans area to work on HSDRRS construction projects will remain after August 2014, when the HSDRRS work is estimated to be complete. However, these businesses will have established local skilled labor and qualifications to compete for future contracts both regionally and nationwide.

The USACE, with the assistance of many academic and professional economists and regional scientists, developed the Economic Impact Forecast System (EIFS) to address the economic impacts of planned Federal actions and to measure their significance. As a result of its designed applicability, and in the interest of uniformity, EIFS was used in the CED to forecast the economic impacts of HSDRRS-related construction and to measure their significance. The user defines an economic ROI by identifying the counties/parishes or cities to be analyzed. Once the ROI is defined, the system aggregates the data, calculates multipliers and other variables used in the various models in EIFS and uses the data to forecast impacts.

The inputs into EIFS are key to the development of valid impact forecasts. The following assumptions were used in these forecasts for the CED analyses:

- The ROI includes Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard parishes
- \$14 billion in expenditures in the ROI from September 2005 through the end of 2011
 - \$1 billion from September 2005 through December 2006 (Task Force Guardian repairs)
 - \$13 billion from March 2007 through December 2011
- “Total” impacts were calculated (rather than “Local”) based on the assumptions that some contractors are based outside the ROI, some workers’ permanent homes are outside the ROI, and some materials/supplies were purchased outside of the ROI.

In addition to benefiting the region by increasing safety, the Federal investments in the HSDRRS played a role in boosting the economy of the Greater New Orleans Metropolitan Area devastated by Hurricane Katrina. The EIFS forecasts the economic impact on the ROI of the \$14 billion in expenditures for the HSDRRS. Expenditures were estimated for each year, EIFS impact forecasts were developed for each year, and the impacts were added together to develop the total forecast impacts shown in table 4-50.

Table 4-50. Estimated Regional Economic Impacts: EIFS Forecast Output

Sales Volume – Direct	\$13,071,237,100
Sales Volume – Induced	\$32,547,384,200
Sales Volume - Total	\$45,618,621,000
Income – Direct	\$2,293,303,940
Income – Induced	\$5,710,326,460
Income – Total	\$8,003,631,200
Employment – Direct	58,916
Employment – Induced	146,704
Employment - Total	205,620

Note: Employment Multiplier: 3.49; Income Multiplier: 3.49
 Source: Economic Impact Forecast System, USACE

The EIFS forecasts that the \$14 billion invested in the HSDRRS had impacts of \$45.6 billion on sales in the region. Sales volume is the direct and indirect change in local business activity and sales (total retail and wholesale trade sales, total selected service receipts, and value added by manufacturing). Approximately \$13.1 billion of the total is direct sales, the immediate first round of sales generated by project expenditures. The remaining \$32.5 billion were sales induced by the initial expenditures. Forecast total income (the total change in regional wages and salaries) resulting from the \$14 billion in expenditures was estimated to be approximately \$8 billion, while forecast employment (direct and induced) was estimated to be 205,620. Annual inputs into and outputs from the model are presented in appendix P.

In addition to generating the impacts shown in table 4-50, EIFS makes a calculation that allows the user to evaluate the significance of the impacts. This analytical tool, known as the Rational Threshold Value (RTV), reviews historical trends for the designated ROI, assesses the historical fluctuations in sales volume, income, employment, and in some cases population, and provides a basis for assessing whether or not the impacts are outside of normal historical variations. It essentially measures the intensity of the impacts.

The RTVs are shown for each year in appendix P. They are not included in table 4-50 because they are calculated independently by year and a total cannot be calculated for the multi-year time period. For this project, the RTVs show that the expenditures in 2005 and 2006 were not sufficiently large to be outside what might be expected based on historical fluctuations. For the years 2007 through 2011, the RTVs indicate that, with the exception of the income RTV in 2007, the HSDRRS expenditures resulted in substantial positive impacts on the region over and above what would have been expected based on historical fluctuations.

Community Cohesion

Impacts of Hurricane Katrina included in many areas, the total loss of neighborhood unity. Conditions brought about by flood risk reduction projects potentially had minor impacts on community cohesion through temporary construction impacts from traffic congestion that potentially “divided” a community, or caused temporary or permanent relocation of local institutions or recreational areas used frequently by the public (e.g., Coconut Beach). However,

no permanent impacts on community cohesion occurred with the implementation of the HSDRRS.

The basic objective of the HSDRRS was to reduce hurricane and storm damage to residences and businesses. Public involvement with the community was part of this process. Many residents and businesses adjacent to the project area were significantly damaged by Hurricanes Katrina and Rita, reducing the potential for community cohesion. As with per capita personal income and community and regional growth, the HSDRRS ensured that all individuals within the 100-year risk reduction system have the same level of risk reduction and, thus, a level of security that allows them to return to their communities.

Environmental Justice

As was previously described in section 1.4, public involvement has been a key component of the NEPA Alternative Arrangement process for the USACE. Through the 200 public meetings, over 6,500 site visits and field trips, postings to the www.nolaenvironmental.com website, notices of availability providing an opportunity for the public to comment for all IERs, and focused neighborhood project design meetings, minority and low-income residents in the Greater New Orleans Metropolitan Area that were potentially impacted by HSDRRS construction activities and borrow site excavation had the opportunity to be involved in HSDRRS planning and design. By incorporating public comments and concerns into all HSDRRS project designs, the USACE has taken into account the potential for any disproportionate impacts on low-income and minority communities with each HSDRRS action, and modified construction implementation plans as necessary.

During the HSDRRS scoping meetings and the CED scoping meeting, the comment or question often arose regarding the timing of the HSDRRS work in low-income and minority communities, in relation to other more affluent non-African American communities. In response, the USACE reiterated that the HSDRRS construction work was approached from the standpoint that *ALL* communities within the HSDRRS project area were provided the same 100-year level of risk reduction. The same series of analysis, design, and construction and environmental planning steps were required to be completed prior to the execution of a construction contract for work on all HSDRRS reaches. However, each HSDRRS action had different challenges that could require specific increases in schedule time for one or more of these steps, which could ultimately affect the execution of the construction contract award. In general, at the beginning of the design process it was unknown which, if any, of these steps caused potential delays in the project execution and ultimately the timing of the construction of that particular action. Therefore, although useful to the public and a way to potentially alleviate concerns of residents of minority and low-income communities, exact construction timelines were not provided in the IERs. Public meetings and press releases were used to track progress on individual IERs as environmental compliance, design, and construction moved forward.

No permanent disproportionate impacts on minority or low-income communities from HSDRRS construction or borrow site excavation occurred. Many HSDRRS reaches are within uninhabited areas or overlay existing levee and floodwall alignment ROWs. Given that these areas had no nearby residents, construction of those HSDRRS reaches had no disproportionate impacts on low-income or minority populations. However, some HSDRRS reaches are adjacent to residences and businesses, and in these reaches, short-term construction impacts were experienced by all residences and businesses located near the HSDRRS, regardless of race or income level. No disproportionate impacts on low-income or minority communities occurred from HSDRRS construction, because all residences and businesses are provided an equal level of risk reduction. Further, all floodwalls, floodgates, pump stations, and levees were built adjacent to communities composed of all income levels and races, and long-term recreational and aesthetic impacts from HSDRRS structures were not disproportionate on low-income or minority residents.

Likewise, many contractor-furnished borrow sites are located in undeveloped areas, and excavation of material in those borrow sites had no disproportionate impacts on minority or low-income communities, because no residents or businesses were located within a 1-mile radius of the borrow sites. However, some borrow sites proximate to residential neighborhoods (within a 1-mile radius), but outside of the HSDRRS boundaries (and therefore, not receiving the risk reduction benefits of the HSDRRS, but experiencing the temporary construction impacts) have the potential for short-term noise, air quality, and traffic impacts on nearby residences, and in some locations, these temporary impacts could only be experienced by minority or low-income communities. Table 4-51 provides a listing of borrow sites where temporary noise and air emissions, and transportation impacts occurred proximate (i.e., within a 1-mile radius) to low-income or minority communities outside of the HSDRRS boundaries, and have the potential for temporary disproportionate impacts on these communities during borrow site excavation. However, no permanent disproportionate impacts occurred on minority or low-income communities from any borrow site excavation, because noise and air emissions and transportation impacts ceased at the end of the use of the borrow site.

Table 4-51. Borrow Sites with Potentially Disproportionate Temporary Impacts on Minorities or Low-Income Communities

IER #	Potential Disproportionate Impact Description
<i>St. Charles Parish</i>	
23	Temporary construction-related impacts on a minority and low-income community from the 3C Riverside* borrow site were potentially disproportionate.
32	Temporary construction-related impacts on a minority and low-income community from the 3C Riverside Phase 3* borrow site were potentially disproportionate.
<i>Jefferson Parish</i>	
18	The Churchill Farms* and Westbank Site G borrow sites have the potential for disproportionate temporary construction impacts on a minority and low-income community.
22	The Westbank Site F borrow site has the potential for disproportionate temporary construction impacts on a minority and low-income community.
<i>Plaquemines Parish</i>	
25	The Tac Carrere borrow site has the potential for disproportionate temporary construction impacts on a low-income community.
32	The Nairn borrow site has the potential for disproportionate temporary construction impacts on a low-income community.
<i>St. Bernard Parish</i>	
18	The 4001 Florissant borrow site has the potential for disproportionate temporary construction impacts on a minority and low-income community.
19	The DK Aggregates borrow site has the potential for disproportionate temporary construction impacts on a low-income community.
<i>Ascension Parish</i>	
32	The Bocage borrow site has the potential for disproportionate temporary construction impacts on a minority community.
<i>St. James Parish</i>	
30	The Big Shake borrow site has the potential for disproportionate temporary construction impacts on a minority community.
<i>St. John the Baptist Parish</i>	
29	Temporary construction-related impacts on a minority and low-income community from the Willow Bend Phase II* borrow site were potentially disproportionate.

Table 4-51, continued

IER #	Potential Disproportionate Impact Description
<i>Hancock County</i>	
19	The Pearlington Dirt Phase 1* borrow site has the potential for disproportionate temporary construction impacts on a low-income community.
23	Temporary construction-related impacts on a minority and low-income community from the Pearlington Dirt Phase 2* borrow site were potentially disproportionate.

*Utilized for HSDRRS construction as of July 2011

4.2.15.2.2 HSDRRS 2057 Impacts

The future levee lifts would cause temporary and sporadic construction impacts on residents and businesses, which would affect the socioeconomic resources and low-income and minority communities in a manner similar to the original levee construction for the HSDRRS improvements. Noise, air quality, and traffic impacts would potentially occur for citizens near these particular levee reaches. Future construction footprints could be greater than the HSDRRS 2011 levee footprints, and potentially require additional ROW acquisition. Should increased ROW be necessary, then any property acquisitions would have limited impacts on property tax revenues. However, maintaining the earthen levees at the 100-year risk reduction level would continue to provide a benefit to the region’s residents, businesses, and industries within the project area, which would in turn reflect positively on employment and income due to a reduction in storm-damaged properties from storm surges and hurricane flood events. No adverse long-term socioeconomic impacts would occur from HSDRRS 2057 construction.

The future levee lifts currently are projected to require 7.3 million cy of borrow and new borrow sites may need to be utilized. Prior to any new borrow sites being developed, the USACE would fully investigate the proposed borrow area’s setting and any impacts on socioeconomic resources, including the potential to disproportionately impact low-income and minority communities near any borrow site. In addition, the USACE would be required to follow any specific parish ordinances (e.g., Jefferson Parish) for any borrow sites, which could further reduce impacts on low-income and minority communities or socioeconomic resources in the borrow project excavation areas. However, temporary impacts on noise, air quality, and traffic impacts would potentially occur to citizens residing near these borrow sites. Additionally, indirect impacts from new borrow sites could include reductions in property values in the vicinity and indirectly lower tax revenues for the parish where the borrow site would be located.

Future expenditures for levee lifts and HSDRRS maintenance activities would provide an economic benefit to the region. These expenditures are not known at this time, but given the volume of material needed for future levee lifts, and the scale of the structural components requiring periodic testing and maintenance, these expenditures in the community would be substantial.

4.2.15.3 Cumulative Impacts

4.2.15.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

The HSDRRS construction and associated excavation of borrow contributed directly and indirectly to short-term cumulative impacts on the socioeconomic resources throughout the project area during construction. Most of the HSDRRS construction and excavation of borrow did not cause disproportionate cumulative impacts on low-income and minority communities within the project area. However, all citizens, regardless of race, income level or age, experienced short-term cumulative impacts during construction due to heightened noise levels, air emissions, and traffic congestion. Lowering flood risk to the Greater New Orleans Metropolitan Area and maintaining that reduced risk of flooding in the future would

cumulatively cause long-term economic and population growth in the region and, thus, would lead to cumulative beneficial impacts on the region's businesses and industries, which would in turn reflect positively on employment and income in the HSDRRS area. Cumulatively, the expenditures in the region for construction, maintenance, and future levee lifts have provided billions of dollars to the economy of the region since Hurricane Katrina. Although this can never replace the value of lost property, productivity, and lives, the expenditures are a significant beneficial cumulative impact of the HSDRRS. No long-term adverse cumulative socioeconomic impacts would occur from HSDRRS construction and borrow site excavation.

4.2.15.3.2 Cumulative Impacts of Present and Future Regional Actions

Present and future actions by the USACE and other local, state, and Federal agencies would contribute to an overall long-term cumulative benefit to socioeconomic resources, as many projects in the area are tied directly to either regional recovery projects and projects to enhance flood risk reduction, or contribute to wetlands and coastal restoration.

Storm Damage Reconstruction

In conjunction with ongoing efforts to restore existing floodwalls, floodgates, and levees throughout the project area, there are ongoing government- and community-based efforts to restore and create new opportunities in the project area. Rebuilding schools, hospitals and clinics, and fire and police protection facilities in the hurricane-affected areas would have a positive effect on overall socioeconomic resources such as increased housing values and population increases, and would provide a better business climate within the project area. These same reconstruction projects would also enhance community cohesion and result in overall positive socioeconomic benefits to all within the system, including minority and low-income communities. Major and minor renovations on municipal buildings, parks, and community centers as part of street repair projects in St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard parishes would improve socioeconomic resources for all citizens in the project area. Some storm damage reconstruction projects could have temporary adverse impacts on nearby businesses, residential housing, and low-income and minority communities in the area due to noise, traffic congestion and road closures, and air quality emissions. However, in the long term, both enhanced and rebuilt facilities and related infrastructure projects would provide benefits to the region due to increases in construction employment, materials procured from local businesses, increases in adjacent property values, and an overall increase in community cohesion and regional growth.

Community revitalization has been a central focus in rebuilding areas affected by the storm. The lack of affordable, stable housing in the city has been defined as one of the central problems of recovery in the area. Several agencies and programs have started rebuilding houses and neighborhoods or provided funding and support for rebuilding in the Greater New Orleans Metropolitan Area such as Habitat for Humanity, Rebuilding Together, the Road Home Program and the Lot Next Door Program. Very recent 2010 projects included the dedication of 50 houses that were restored and made safe in the Gentilly area over the course of 5 days as part of a Rebuilding Together *Fifty for Five* effort. In many cases these efforts are focused on low-income and minority populations, which would have positive direct cumulative beneficial impacts on these communities.

Additional short-term benefits on community and regional growth would result as local, state, Federal agencies and non-profits in the area spend money in the region on storm damage reconstruction. Several Federal agencies (e.g., Department of Homeland Security, FEMA, HUD) have authorized spending in the hurricane-affected areas. For example, HUD spent \$16.7 billion in Federal funds in their Community Development Block Grants program helping to rebuild damaged housing and other infrastructure (Department of Homeland Security 2008). FEMA has funded \$5.5 billion to repair and replace damaged public infrastructure and the U.S.

Department of Transportation spent \$2 billion to repair and rebuild highways and bridges in Louisiana and Mississippi. The overall economic benefit from these projects, when combined with the \$14 billion spent on the HSDRRS, would result in long-term beneficial impacts in the region in terms of jobs, materials and supplies, and other expenditures.

Redevelopment

In general, redevelopment in all the affected parishes would have beneficial long-term socioeconomic impacts on the region, including low-income and minority communities. However, short-term impacts due to these construction activities could cause traffic congestion and construction noise and air quality issues. Additionally, depending on where these projects are located and if these projects cause increased property values, there could be disproportionate impacts on low-income populations throughout the project area.

Should new housing developments or other construction projects occur within jurisdictional wetlands, the developers are required to submit permit applications to the USACE Regulatory Permit Office, per Section 404 of the CWA. Private developers and homeowners nationwide, as well as within the HSDRRS project area, rely upon the availability of wetlands mitigation banks to meet the compensatory mitigation requirements of their CWA 404 permits. Mitigation banking is the use of a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or preserved for the purpose of providing compensation for unavoidable impacts on aquatic resources authorized by Department of the Army permits. A mitigation bank may be created when a public or private entity undertakes compensatory activities under a formal agreement with the Corps of Engineers. Mitigation banks are generally approved for a specific geographic area known as the service area, and an Interagency Review Team reviews the banking instrument for the bank and advises the District Engineer on the establishment and management of the bank. The value of a bank is defined in "compensatory mitigation credits," which are available for sale and utilizes ecological assessment techniques to certify that those credits provide the required ecological functions. In other words, mitigation banks allow Section 404 permit holders the ability to transfer their liability for adverse impacts on jurisdictional wetlands and non-jurisdictional BLH for the design, construction, monitoring, ecological success, and long-term protection to another site or a third party.

There are a limited number of mitigation banks within the HSDRRS watersheds. The USACE's online Regulatory In-lieu Fee and Bank Information Tracking System, called RIBITS, indicates that there are 59 mitigation banks in the CEMVN regulatory boundaries. Of those, 13 are sold out and one is suspended. Of the remaining 45 active and approved banks only a portion of those are within the HSDRRS project area or adjacent to the HSDRRS project area's Hydrologic Unit Code (USACE 2011a). Private developers and homeowners rely upon the availability of wetlands mitigation banks to meet the mitigation requirements of their CWA Section 404 permits.

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects, including the restoration or creation of marshes, would increase the sustainability of southeast Louisiana through the maintenance of recreational and commercial fishing, tourism, hunting, boating, and storm surge reduction. Increased access to the marsh and coastal areas would allow for increased ecotourism, which would thereby increase business income and jobs within the region.

Wetlands and coastal restoration in south Louisiana would aid in storm surge risk reduction. In addition, several proposed wetlands restoration projects in the project area could improve water quality in several nearby water bodies, including Lake Pontchartrain, Lake Salvador (shoreline protection), the MRGO, and Lake Borgne. Marsh restoration projects such as Management of Rosethorne Municipal Effluent and South Shore of the Pen Shoreline Protection, Marsh Restoration in Jefferson Parish (\$63 million for 10 miles of shoreline [Save Our Lake 2005]),

and the operation of the Caenarvon freshwater diversion canal, could also improve aquatic habitat and potentially provide habitat for fish displaced from construction-related impacts. The marsh restoration projects could create positive impacts for the seafood industry and create more job opportunities within the project area and region. Additionally, for those low-income populations that practice subsistence fishing, the improvement in aquatic habitat would have indirect beneficial impacts on minority and low-income communities.

Flood Risk Reduction Projects

Levee modification along the Mississippi River and MRGO deep-draft deauthorization would temporarily impact socioeconomic resources and low-income and minority communities in the Greater New Orleans Metropolitan Area. Approximately \$24 million was spent to construct the MRGO total closure structure (USACE 2009o).

The estimated cost for the NOV project is between \$857 million and \$1.29 billion, and the available project funding is \$769 million. The estimated cost for the New Orleans to Venice, Incorporation of Non-Federal Levees project is \$456 million, and the available funding is \$671 million. These estimated costs include mitigation. To date, \$500 million has been spent on SELA projects (since 1997), another \$100 million in emergency money was spent on seven SELA projects, and there are \$345 million in expenditures remaining to be spent in the region (SELA 2010). These projects' expenditures and construction activities would provide a temporary cumulative economic boost to the area and affect low-income and minority communities similar to the HSDRRS construction activities. However, the socioeconomic resources of all communities in the area would be improved in the long term with the reduced risk of flooding, and no long term disproportionate impacts on low-income or minority communities would occur.

Although these flood risk reduction projects, along with others, would contribute to additional temporary adverse impacts on residents and businesses from construction activities, socioeconomic benefits in the region due to increased jobs, and spending on supplies and materials in the area would offset any disproportionate short-term impacts on low-income and minority communities in the project area.

Transportation

There would be beneficial effects on jobs, and material and equipment expenditures in the project area and region from large transportation projects. There is the potential for short-term (construction) and long-term disproportionate cumulative impacts on low-income and minority communities in the project area from transportation projects. Additionally, transportation projects that bisect neighborhoods, such as the IHNC Lock Project, can adversely impact community cohesion. However, all Federally funded projects are required to evaluate the socioeconomic impacts, including evaluating Environmental Justice issues, and would seek to avoid disproportionate impacts or would mitigate the impacts. Alternatively, regional transportation projects would aid in reducing traffic congestion and provide a better quality of life for working commuters, which is a beneficial cumulative impact on residents of the region, regardless of race or economic status.

4.2.15.3.3 Summary of All Cumulative Impacts for Socioeconomic Resources and Environmental Justice

Cumulatively, the disruption of waterways from construction activities, the changes in commercial and recreational fishing activities and previous closures of water bodies in the region from the BP oil spill, and temporary closures of waterways from bridge construction and lock replacement projects would cause direct adverse impacts on industries that rely heavily on barge traffic and on commercial fisheries. Large construction projects have short-term socioeconomic impacts regionally on residents and businesses from increased noise, dust, and traffic congestion.

Periodic lane and road closures that delay and idle traffic have indirect cumulative economic adverse impacts due to time lost from other economic-generating activities. All of these projects have the potential to disproportionately impact low-income and minority communities. However, although there would be adverse cumulative impacts on socioeconomic resources within the project area, most of these impacts would be short-term and occur only during ongoing construction activities of the HSDRRS and other regional projects.

Many Federal agencies (e.g., DoD, FEMA, HUD) have authorized spending in the hurricane-affected areas. Short-term and long-term benefits on community and regional growth would result as local, state, and Federal agencies and non-profits in the region continue to spend money in the region on storm damage reconstruction, redevelopment, coastal and wetlands restoration, and other flood risk reduction projects. These tens of billions of dollars of investments all have an economic multiplier effect which, when combined with the \$14 billion spent on the HSDRRS, results in long-term beneficial impacts in the region in jobs, sales of materials and supplies, housing values, and other expenditures. Additionally, the greater level of risk reduction provided by the HSDRRS and other risk reduction projects regionally would cumulatively improve economic conditions in the long-term through reduced insurance costs and greater investment. Thus, the long-term regional cumulative impacts on socioeconomic resources would be predominantly beneficial and are considered by the majority in the region and the Nation as essential.

4.2.16 Hazardous, Toxic, and Radioactive Waste

4.2.16.1 Affected Environment

Methodology

Risk Reduction IERs

HTRW Land Use Histories Review and an American Society for Testing and Materials (ASTM) E 1527-05 Phase I ESA were completed for each applicable HSDRRS project area. The main objective of the Phase I ESA was to document any Recognized Environmental Conditions (RECs) for the work area. If under the HSDRRS action a REC cannot be avoided due to specific construction requirements or in the event of an unplanned discovery of HTRW materials during construction, construction work that could affect the contaminated materials was stopped. At that time, it was determined if local, state, or Federal coordination was required and the USACE either further investigated the REC to characterize the nature and extent of the contamination and determine the appropriate resolution, or took actions to avoid any possible contaminants.

Should the USACE environmental manager determine that too much time had elapsed since a Phase I ESA was performed, in accordance with the USACE HTRW Guidance for Civil Works Projects (ER-1165-2-132) and the ASTM Standard for Phase I ESA Investigations (ASTM E 1527-05), a site inspection, interviews, and review of environmental data were done to assess current conditions and to determine if any changes had occurred since the previous Phase I ESA. Copies of the Phase I ESAs are maintained on file with the USACE CEMVN.

Borrow IERs

While investigating potential borrow sites, a preliminary site approval was first completed, followed by a site visit. The field team typically consisted of a Project Manager, HTRW investigator, and other team members. The area was visually inspected for the presence of obvious HTRW issues. If no HTRW concerns were observed, the area would be cleared to proceed with geotechnical borings to identify soil characteristics; a Phase I ESA would be completed to confirm that no RECs were found. Also, according to the ASTM standard (ASTM E 1527-05), a Phase I ESA is presumed to be valid for 6 months after completion. Therefore, if the Phase I ESA was older than 6 months, an addendum or new Phase I ESA would be done to update the original Phase I ESA, prior to borrow excavation.

4.2.16.1.1 Existing Conditions

In general, areas that had construction done on applicable levee and alignment reaches to bring the system to post-Hurricane Katrina standards were previously investigated by a Phase I ESA in the last 3 years. However, in many cases a new Phase I ESA was performed for the HSDRRS construction. Usually, the Phase I ESA found no RECs within the project ROW, but RECs were identified on nearby or adjacent properties in some cases. Table 4-52 summarizes the ESAs conducted in support of the HSDRRS in which there were no RECs associated with the HSDRRS project footprint.

Table 4-52. Risk Reduction IERs with No RECs on Project Footprints by Sub-basin

IER* #	Investigation/Date	Findings	Discussion
<i>Jefferson East Bank Sub-basin</i>			
3/S 3.a	Phase I ESA October 2007	No RECs within the project area	Twenty suspected RECs within 1,000 ft of levee corridor.
<i>Orleans East Bank Sub-basin</i>			
4	Phase I ESA November 2006	No RECs within the project area	None
<i>New Orleans Sub-basin</i>			
6/S 6	Phase I ESA March 23, 2007 Site Reconnaissance April 6, 2009	No RECs within the project area	None
7/S 7	Phase I ESA March 2007	No RECs on the project area except for a suspected REC at LPV-109	None (see following IER #7 write-up for affected environment discussion)
<i>Chalmette Loop Sub-basin</i>			
8	Phase I ESA November 2006 Addendum March 24, 2009	No RECs within the property	None
10	Phase I ESA September 2007	No RECs within the property	None
<i>Lake Cataouatche Sub-basin</i>			
15	Phase I ESA December 4, 2007	No RECs within the property	None
16/S 16	Phase I ESA 2008	No RECs within the property	None
17	Phase I ESA May 21, 2007	No RECs within the property	Aboveground Storage Tanks (ASTs) are on-site, but no history of releases; USACE would be working primarily within the previously established ROW

*S – Supplemental

HSDRRS Projects

At times, the HSDRRS reaches detailed in the IERs had HTRW issues as discovered by Phase I ESAs; these instances are discussed below.

St. Charles Sub-basin (IER #1 and IER Supplemental #1)

The records review revealed one site (Motiva Enterprises, Norco Refinery) near the LaBranche Wetlands Levee project that could have impacted the project area, due to the site history and proximity. This refinery has been in operation since 1916 and has contributed to sediment contamination in Bayou Trepagnier. LDEQ and Motiva Enterprises have reached a cooperative agreement to remediate the sediment contamination in the portion of Bayou Trepagnier that would be impacted by the project. This cleanup process has not begun and is not expected to be complete before the HSDRRS construction. Therefore, a no-work zone would be designated for this area, and no work will be done within that designated area until the site remediation process has been completed.

Orleans East Bank Sub-basin (IERs #5 and #27)

Both IERs #5 and #27 included HSDRRS actions that surround the 17th Street, Orleans Avenue, and London Avenue canals. The following information deals with any HTRW or RECs concerning these canals. Relevant studies are listed in chronological order below:

- Sediment sampling and analysis for all three outfall canals performed in March 2006.
- Phase I ESAs for all three outfall canals performed in November 2006.
- Updated Phase I ESAs for all three outfall canals performed on January 3, 2008.
- Initial site investigations for additional project features performed on February 8, 2008.
- Phase II ESAs for each of the three permanent pump station locations on the outfall canals completed in March 2009.

A Phase I ESA was completed for each of the three outfall canals in November 2006. The Phase I ESA evaluated the Sites of Concern (SOCs) within 0.125 mile of the centerline of the 17th Street, Orleans Avenue, and London Avenue canals and identified the findings of the previous investigation as the RECs for the canals. On January 3, 2008, the three outfall canals were inspected to assess current conditions and to determine if any changes had occurred since the November 2006 Phase I ESAs. RECs identified are summarized and listed as follows:

- 17th Street Canal - Six ASTs, five with approximately 10,000-gallon capacities and one with a 1,000-gallon capacity, are currently at the canal closure structure. Three different areas containing formerly leaking underground storage tanks (LUST) are along the project corridor. No electrical transformers were observed within the project corridor. At least 20 utility-pole-mounted electrical transformers were observed on adjoining property to the west of the project corridor, and at least 45 pole-mounted transformers were observed on adjoining property to the east of the project corridor. A large electrical transformer mounted on a slab was observed on adjoining property. One pole-mounted transformer on the western canal bank (north of Cherry Street) and four pole-mounted transformers on the eastern canal bank exhibited signs of corrosion. It is not known whether the transformers observed on the adjoining properties contain PCB, but no evidence of corrosion or rupture was observed on the transformers.
- Orleans Avenue Canal - Findings included two approximately 3,000-gallon unused ASTs that are scheduled for removal and two additional ASTs with approximately 10,000-gallon capacity near the canal closure structure. A heavily oiled absorbent barrier was observed traversing the canal. No electrical transformers were observed within the project corridor. At least 30 electrical transformers were observed on adjoining property,

but it is not known whether the transformers observed on the adjoining properties contain PCB, and no evidence of corrosion or rupture was detected on the transformers.

- London Avenue Canal - Four ASTs, approximately 10,000 gallons each, are at the canal closure structure, and two oil-absorbent barriers were observed traversing the canal. Other observations included two approximately 3,000-gallon ASTs, which appeared to be in disrepair or possibly unused/abandoned, and one approximately 1,000-gallon AST containing diesel.

In addition to the updated Phase I ESAs, initial site investigations were prepared for additional project features on February 8, 2008. The project corridors were inspected to assess current conditions, and the investigation included visual inspection and review of environmental data. Relevant and significant findings and recommendations indicate that the Orleans Avenue and London Avenue Canals records reported some of the commercial facilities in the southern portion of the corridors along the drainage canals have had environmental compliance issues. A LUST facility requiring no further action was also identified adjacent to the sites.

An ASTM E 1903-97 Phase II ESA was completed for each of the three permanent pump station locations on the outfall canals in March 2009. This Limited Phase II Assessment included sediment sampling of the proposed permanent pump station locations for each of the three outfall canals. Contaminants of concern (COC) within the canal sediments were compared with the State of Louisiana Risk Evaluation Corrective Action Program (RECAP) Standards for evaluation of the risk to human health and the environment. While the RECAP Screening Standards are not directly applicable to the sediment matrix, the standards provide a good indication of the level of contamination and associated risk of chemical concentrations in the sediments. COC concentrations of low risk were determined to exist in the sediments in each of the canals and are noted as follows:

- 17th Street Canal - Nearby SOCs contained COCs of trichloroethylene, total petroleum hydrocarbons (TPH)-diesel range organics, TPH-oil range organics, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, phenanthrene, pyrene, carbon disulfide, arsenic, barium, chromium, and lead.
- Orleans Avenue Canal - Nearby SOCs contained COCs of petroleum products, benzo(k)fluoranthene, arsenic, barium, chromium, and lead.
- London Avenue Canal - Nearby SOCs contained COCs of TPH-diesel range organics, TPH-oil range organics, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, n-nitrosodi-n-propylamine, 4,4'-dichlorodiphenyl trichloroethane (DDT), arsenic, barium, chromium, and lead.

Phase I HTRW ESA Update Memoranda were done for the 17th Street (December 17, 2010), Orleans Avenue (November 9, 2010), and London Avenue Canals (October 28, 2010). No RECs were found that would affect the project, personnel working on the project, or the public.

New Orleans East Sub-basin (IERs #11 Tier 1, Tier 2 Pontchartrain, Tier 2 Borgne)

For IER #11 Tier 1, numerous Phase I ESAs were prepared for the USACE, and a Phase II ESA was conducted to further analyze suspected contaminants. These ASTM Phase I and II ESAs are listed below:

- Final Phase I ESA - Seabrook Site, New Orleans

- Final Phase I ESA - GIWW and MRGO Option 1 Corridor (East of Michoud Canal and East of Bayou Bienvenue), New Orleans
- Final Phase I ESA - GIWW and MRGO Option 2 Corridor (Chef Menteur Area and East of Bayou Dupre), New Orleans
- Final Phase II ESA - Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip, New Orleans

The Tier 2 IERs document that further HTRW investigations were performed to describe the conditions within the selected location ranges and to aid in avoidance of RECs and hazardous waste during the USACE construction activities.

The Phase I ESAs documented RECs for the IER #11 Tier 2 Pontchartrain action areas, and the Phase II ESAs were conducted to further analyze suspected contaminants. The dates of the assessments and investigations are listed below:

- Final Phase I ESA performed in November 2006 - Seabrook Site
- Final Phase II ESA performed in December 2007 - Proposed Closure Structures - Seabrook, GIWW-MRGO, Michoud Slip
- Final Limited Phase II ESA performed in November 2009 - Proposed Seabrook Gate

These ESAs are located within the HSDRRS project area, and relevant and significant findings and recommendations are summarized below.

Seabrook Site - The site investigated under the November 2006 Phase I ESA is located at the confluence of Lake Pontchartrain and the IHNC. There are no RECs identified at the site; however, on property outside of the project area on the west bank of the IHNC, LDEQ required a residential deed restriction due to the rupture of a used oil tank in 1998 on the property.

Seabrook Closure Structures - The Phase II ESA performed in December 2007 investigated baseline conditions of the project area at the confluence of the IHNC and Lake Pontchartrain (near Seabrook Bridge). Should sediment near the construction footprint be excavated or dredged and subject to land management and disposal, based on sampling and testing of sediment collected from a total of 21 boring locations, only one location with unacceptable concentrations of contaminants was found. Two COCs (barium and lead) above the LDEQ RECAP standards are present in the sediment at this one location in the canal at Seabrook (Tier 2 Pontchartrain project area). However, the COC levels are below what is considered hazardous waste as defined by CFR 261.24 for barium, and appear to be an isolated occurrence, due to the fact that both barium and lead concentrations in samples from adjacent sediment boring locations in the IHNC at Seabrook are significantly lower. However, the analytical results and past and current site usage suggest the need for additional investigation.

On February 2009, another Phase I ESA was conducted in the vicinity of the floodwall footprint along the IHNC. No new RECs were identified in this assessment; however, the industrialized nature of the area was noted.

On April 14, 2009, a site reconnaissance was conducted for the Seabrook area. No significant changes appear to have occurred on the adjacent properties since the original Phase I ESA, except some construction activities on the west end of the property. A fenced-in area along LeRoy Johnson Drive, formerly the Naval Reserve Training Center (demolished), contained scrap metal and other scrap demolition materials. East of Jourdan Road is the New Orleans

Lakefront Airport that operates an active AST field with four tanks containing aviation gas. The ASTs are immediately adjacent to the target property site for the sector gate construction in Lake Pontchartrain. No RECs or obvious signs of major contamination were discerned during the site reconnaissance of the Seabrook area.

The original HTRW study, entitled *Phase I Environmental Site Assessment, Lakefront Levee, (LPV-101 through 104), Orleans East Bank, 17th Street Canal to Inner Harbor Navigation Canal*, was completed in November 2006. No RECs were found within the project vicinity; however, the report did note a few locations of possible environmental concern, such as LUSTs.

An addendum to the November 2006 Phase I ESA, dated May 5, 2009, also investigated possible RECs within the project areas that may have been overlooked by past investigations, as well as the status of environmental issues noted in previous Phase I and Phase II ESAs. These reports presented several sites of concern; however, further investigation of HTRW impacts was not recommended. The most recent site reconnaissance did not present RECs or areas of concern to warrant further investigation.

Seabrook Gate - A limited Phase II ESA was done in November 2009 for soil and sediment samples from the Seabrook gate complex construction site, south of the Seabrook Bridge and the Bascule Railroad Bridge, as recommended in the 2007 Phase I ESA. Based on the sampling and testing of soil and sediments collected from a total of 12 boring locations (three soil and sediment samples from each side of the bank), the soil samples from the west bank of the IHNC indicated no significant contamination, with the exception of barium, which exceeded the RECAP screening level. The elevated barium concentrations were attributed to historical oil drilling in the area. The IHNC east bank samples had TPH, polycyclic aromatic hydrocarbons (PAH), arsenic, and barium levels above RECAP screening levels, which may be attributed to a surface spill from boating or historical rail activity. There was no significant contamination identified from sediments on the west side of the IHNC. The PCB, PAH, DDT and elevated metals (antimony, lead, and barium) contaminant levels from the east side of the IHNC sediment samples may have resulted from the existence of a historic lead facility in the area and historic oil drilling activities. Only arsenic and PAH levels from soil samples on the east side of the bank were above RECAP industrial standards. These locations of elevated concentrations will require appropriate personal protective equipment and precautions for exposures to construction workers during the construction phase. The soil at sample locations B10 and B12 contains concentrations of arsenic (B10) and PAHs (B12) that exceed the industrial screening standards. If excavation is necessary in these areas, management by disposal at a permitted facility or placement in an area with limited or no potential for exposure (an area such as the confined disposal facility near the MRGO) would be required. The soil in these areas is characterized as non-hazardous (by toxicity characteristic leaching procedures [TCLP]) for disposal purposes. Confirmatory sampling, as specified under a Corrective Action Plan, would be necessary in conjunction with the excavation prior to backfilling. If excavation is not necessary at B10 and B12, leaving the soil in place and capping or covering the areas with a permanent structure to prevent exposure is an option. The elevated concentrations in these locations do not exceed the RECAP screening standards protective of groundwater, so direct exposure to the soil is the only issue.

Phase I ESAs documented the RECs for the IER #11 Tier 2 Borgne project areas, and a Phase II ESA was conducted to further analyze suspected contaminants and verify the nature of sediments at the construction footprint(s) of the closure gates detailed in the IER. The following Phase I and Phase II ESAs were prepared:

- Final Phase I ESA - GIWW and MRGO Option 1 Corridor (East of Michoud Canal and East of Bayou Bienvenue), November 2006

- Final Phase I ESA - GIWW and MRGO Option 2 Corridor (Chef Menteur Area and East of Bayou Dupre), November 2006
- Limited Phase I ESA - Proposed Site, July 2008
- Final Phase II ESA - Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip, December 2007

Option 1 Corridor - The site investigated under this Phase I ESA includes locations of the proposed gate east of the Michoud Canal and the closure east of Bayou Bienvenue, as well as the corridor connecting these two proposed gates. The Phase I ESA revealed one REC including five barges (with two sunken) located approximately 200 yards east of the Michoud Canal at the Borgne 1 HSDRRS action area. At the time of the site investigation in October 2006, one barge was surrounded by a boom. Any contamination associated with the barges at their location within the GIWW has been investigated, and results are included in the Final Phase II ESA discussion to follow.

Option 2 Corridor - The site investigated under this Phase I ESA includes locations of the proposed gate at the Chef Menteur area along GIWW and closure at Bayou Dupre along the MRGO. The site investigation also includes the corridor between Chef Menteur and east of Bayou Dupre. The Phase I ESA revealed no evidence of RECs that could potentially impact the project area.

Proposed Closure Structures - The December 2007 Phase II ESA investigated the possible construction sites of the HSDRRS action(s): (1) at the confluence of the IHNC and Lake Pontchartrain (near Seabrook Bridge); (2) at the confluence of the MRGO and the GIWW (east of the Bayou Bienvenue-Michoud Canal corridor), as well as the former barge area near the Michoud Canal; and (3) east of the Michoud Slip. Based on sampling and testing of sediment collected from 21 boring locations, only one location with unacceptable concentrations of contaminants was found. Concentrations of contaminants tested on the Borgne 1 area (at the confluence of the MRGO and the GIWW), including, but not limited to, volatiles, semi-volatiles, PCB, herbicides, and pesticides, are all below screening levels.

In July 2008, a limited Phase I ESA was also conducted on the subject site to assess potential health and safety risks to construction personnel on the project, and to facilitate the proper disposal of any excavated material. Two RECs had been identified on adjacent properties that had the potential to influence the subject site, which the USACE planned to use for construction material and equipment staging. The BOC Gases (BOC) facility is considered a historical REC and the U.S. Filter facility is considered a REC. The BOC and U.S. Filter facilities had LUST conditions adjacent to the subject site. The BOC facility was given a No Further Action Required status from LDEQ, and monitoring is ongoing at the location. The soil sampling effort conducted at the subject sites was aimed at addressing the two identified environmental concerns, specifically that contaminants had not migrated onto the site from either the U.S. Filter or BOC facilities. The chemical composition of the staging area soil was evaluated, with consideration of the anticipated land use (industrial-construction), to ensure that the material did not pose unacceptable risk. The evaluation was based upon a comparison of the analytical results with applicable screening standards under the 2003 LDEQ RECAP. With the exception of one low-level concentration of benzene (composite sample), no COCs were found to exist at the site that were above RECAP Screening Standards. The concentration was just above the limiting RECAP standard for soil protective of groundwater. Benzene was not detected in a split sample that was collected from the same composite sample. Therefore, it is likely that the low-level benzene contamination is in an extremely localized area and does not present a potential impact on groundwater.

Chalmette Loop Sub-basin (IER #9)

Two Phase I ESAs, one in September 2007 and the other in March 2008, documented RECs in the HSDRRS project area. Seven RECs were found, and a Phase II ESA was completed to evaluate the nature and extent of some of the RECs identified in the Phase I ESA. Chemical data were collected near the RECs, including 14 soil samples and two sediment samples. Evaluation of the data indicated that release of contaminants had occurred on the property; however, levels of most detected contaminants were low. Contaminant concentrations exceeding the LDEQ RECAP guidelines for non-industrial screening standards were limited to three locations, consistent with industrial activities within the alternative alignments. If one of these alternatives would have been selected and hazardous waste encountered during construction, the contamination would have been managed following RECAP screening and management options. Contaminant sources are presumed to include historical industrial use of the property, anthropogenic sources, and the movement of contaminants by Hurricanes Rita and Katrina.

Belle Chasse Sub-basin (IER #13)

A Phase I ESA was completed for the project analyzed in IER #13 in July 2006, with an additional Phase I ESA performed on January 25, 2008. Five RECs were found north of the Hero Canal in the vicinity of the project area, with the most notable being an active landfill in the vicinity of the project area, with the potential for landfill materials to exist within the alternative to the chosen levee/floodwall alignment. A Phase II ESA, dated October 10, 2006, was conducted in the vicinity of the landfill area to investigate HSDRRS alternative impacts.

Gretna Algiers Sub-basin (IER #12 and IER Supplemental #12)

The Phase I ESAs documented numerous RECs for the HSDRRS project area, with most of the RECs located along the Harvey and Algiers Canals in areas of commercial industry. The Harvey Canal and Algiers Canal areas have been heavily industrialized since World War II. There is widespread low-level contamination of soil throughout the area, and it is often better not to disturb such material, as it poses less risk when left in place than when disturbed. For this reason, the Algiers Canal sediment is being tested for contamination in the HSDRRS areas for dredging, as well as other sample sites. Dredged material and disposal plans for Algiers Canal were completed.

Harvey Westwego Sub-basin (IER #14 and IER Supplemental #14.a)

A Phase I ESA was completed for the project area on March 27, 2008. The Phase I ESA documented numerous RECs for the project area, none of which were considered significant.

Lake Cataouatche Sub-basin (IER Supplemental #16.a)

Since the Phase I ESA for this project area was completed, additional changes in project design have occurred that enlarged the HSDRRS footprint. Additional evaluation was conducted to address the expanded project footprint. While RECs were identified in the expanded project footprint, these RECs involve oil and gas utilities that require relocation. There are no outstanding HTRW issues in the expanded project footprint. The RECs included pipelines belonging to United Gas, Shell Pipeline Company, LGS Gas, Evangeline Gas, and Gulf South, and other utilities, such as a fiber-optic cable laid by Qwest Communications.

There was no evidence of HTRW problems associated with these pipelines, but due to the nature of these RECs, the potential existed for problems to arise. No further study of HTRW was recommended for the relocation areas associated with the HSDRRS Western Tie-In project (IER #16 and IER Supplemental #16.a); however, if any problems arose during construction

activities, an appropriate response plan was developed. If a REC cannot be avoided, due to construction requirements, the REC was further investigated to confirm presence or absence of contaminants and actions to avoid possible contaminants, such as the removal of contaminated soils.

HSDRRS Borrow IERs

During investigations of potential borrow sites, a preliminary site approval was completed, and typically, a Phase I ESA was performed at the borrow site. In many cases, no RECs were found within the project ROW, while in other cases, RECs were not found on the project footprint, but were identified on nearby or adjacent properties. Table 4-53 denotes the borrow IERs in which there were no RECs associated with the HSDRRS borrow project footprint, sorted by parish/county. As the borrow IERs had more than one site within the IER Proposed Action, multiple IERs may be listed in the table. A discussion follows the table for all HSDRRS borrow sites with HTRW issues in or near the site footprint.

An addendum to update the original Phase I ESA will be completed before excavation of any site for which 18 months have passed since the initial Phase I ESA site visit.

Jefferson Parish (IERs #18, #22, #25, and #28)

The Phase I ESA for Churchill Farms Pit A was completed on June 22, 2007. Three RECs were found: a stockpile of nitromethane, ASTs for diesel fuel, and an old oil well site. The Phase I ESA for Westbank Site G was completed on July 21, 2007, and two abandoned oil/ gas wells were identified. No other RECs were found, and the locations of the RECs were mapped.

The Phase I ESA for Westbank I was completed on September 11, 2007. Concerns were noted on the west-central portion of the site from the use of lead shot at the adjoining skeet and trap shooting range. Additional concerns were noted from the former drilling operations at three documented wells in the southern portion of the subject site. Off-site concerns were noted for one former well site located approximately 0.1 mile east of the subject site. The locations of the on-site RECs were mapped, and the possible off-site REC is outside of the construction footprint.

The Phase I ESA for Westbank D was completed on February 25, 2008. The site is located adjacent to the River Birch C&D Landfill. One producing but now plugged and abandoned well on the southern border of the site was operational between 1964 and 1970. No evidence of this well was observed at the subject site. One plugged and abandoned gas condensate well in the central portion of the site, along the western border, was listed as operational between 1965 and 1970. This historic site is suspected of potentially negatively impacting the subject site. Soil sampling is recommended at the well sites and also at the northwest corner of the site, where leachate from the landfill may have affected the site. Soil testing would be done before any excavation proceeds.

The proposed Westbank E site Phase I ESA was completed on January 30, 2008. Concerns were noted at a residential site (ASTs and several drums near a barn), in addition to two plugged and abandoned wells. Off-site concerns were noted from the current and historical presence of a landfill located on the southwest adjoining property and two additional plugged and abandoned wells.

The locations of the RECs found at Westbank D and E proposed sites were mapped and the affected areas could be avoided.

Table 4-53. The HSDRRS Borrow IERs with No RECs near Project Footprints by Parish/County

IER #	Investigation/Date	Findings	Discussion
<i>Orleans Parish</i>			
19	Phase I ESA February 19, 2007	No RECs within the project area	Eastover site
29	Phase I ESA January 2008	No RECs within the property	Eastover Phase II borrow area
<i>Jefferson Parish</i>			
19	Phase I ESA August 10, 2006/ September 13, 2007	No RECs within the project area	ESAs for River Birch Phase 1 and 2 sites
22	Phase I ESA January 29, 2007	No RECs within the project area	Westbank F proposed site
26	Phase I ESA July – August 2007	No RECs within the property	Willswood and South Kenner Road sites completed on July and August, 2007, respectively
31	Phase I ESA March 2009	No RECs within the property	River Birch Landfill Expansion property
<i>St. Bernard Parish</i>			
18	Phase I ESA October 2006 - November 2007	No RECs within the project area	The Phase I ESA for the 1418/1420, 1572 Bayou Road proposed sites were completed on October 13, 2006 and the Phase I ESA for 4001 Florissant completed on November 8, 2007.
19	Phase I ESA August 2006, and January through March 2007	No RECs within the project area	The Sylvia-Guillot proposed site Phase I ESA was completed on January 29, 2007, with DK Aggregates completed on March 5, 2007 and Gatién-Navy Camp Hope completed on August 14, 2006, although site would be revisited prior to use.
28	Phase I ESA May 30, 2008	No RECs within the property	Johnson/Crovetto proposed site
30	Phase I ESA July 2008	No RECs within the property	Contreras Dirt property
31	Phase I ESA March 2009	No RECs within the property	Spoil Area proposed property, Phase I ESA for site should be updated prior to use
Parishes/County Outside of HSDRRS Project Area			
<i>Ascension Parish</i>			
32	Phase I ESA October 17, 2007 November 2008	No RECs within the property	Proposed Bocage site

Table 4-53, continued

IER #	Investigation/Date	Findings	Discussion
<i>Lafourche Parish</i>			
31	Phase I ESA date not known	No RECs within the project area	Raceland Raw Sugars proposed site
<i>St. Charles Parish</i>			
23	Phase I ESA July 23, 2007	No RECs within the project area	3C Riverside site
<i>Plaquemines Parish</i>			
18	Phase I ESA Triumph site November 4, 2005	No RECs within the project area	Triumph proposed site
19	Phase I ESA June 1, 2007	No RECs within the project area	Kimble #2 proposed site
22	Phase I ESA September 11, 2007	No RECs within the project area	Brad Buras proposed site
23	Phase I ESA November 27, 2007	No RECs within the project area	Myrtle Grove proposed site
25	Phase I ESA March 03, 2008	No RECs within the project area	Tac Carrere proposed site Phase I did locate trash, an abandoned vehicle, waste auto parts, tires, and building debris on-site. These waste materials can be easily removed and should not pose any impact to the intended use of the property by USACE.
26	Phase I ESA June 01, 2007	No RECs within the property	Meyer proposed site
28	Phase I ESA September 24, 2008	No RECs within the property	Bazile proposed site
31	Phase I ESA March 2009	No RECs within the property	Scarsdale proposed site
32	Phase I ESA February 3 and 13, 2009	No RECs within the property	Citrus Lands and Plaquemines Dirt & Clay borrow sites
<i>St. Bernard Parish</i>			
23	Phase I ESA July – September 2007	No RECs within the project area	Phase I ESAs for 1025 Florissant site completed on September 11, 2007 and the Acosta site on July 04, 2007.
31	Phase I ESA July 29, 2009	No RECs within the property	Acosta 2 site
<i>Iberville Parish</i>			
19	Phase I ESA May 25, 2007	No RECs within the project area	St. Gabriel Redevelopment proposed site

Table 4-53, continued

IER #	Investigation/Date	Findings	Discussion
<i>St. James Parish</i>			
30	Phase I ESA July 15, 2008	No RECs within the property	Big Shake proposed property
<i>St. John the Baptist Parish</i>			
26	Phase I ESA January 2008	No RECs within the property	Willow Bend site
29	Phase I ESA February 12, 2009	No RECs within the property	Willow Bend Phase II borrow site
<i>St. Tammany Parish</i>			
29	Phase I ESA July 23, 2008	No RECs within the property	Tammany Holding borrow area
31	Phase I ESA January 27, 2010	No RECs within the property	Levis proposed site
<i>Hancock County</i>			
19	Phase I ESA September 15, 2006	No RECs within the project area	Pearlington Dirt Phase 1 ESA will be revisited prior to use.
23	Phase I ESA November 9, 2007	No RECs within the project area	Pearlington Dirt Phase 2
26	Phase I ESA March 2008	No RECs within the property	Frierson proposed site
30	Phase I ESA July 31, 2008	No RECs within the property	Henley borrow site
31	Phase I ESA December 2006 through March 2008 Addendums July through September 2008	No RECs within the properties	The Kings mine proposed site Phase I ESA was completed on December 20, 2006 with an addendum performed on July 30, 2008. Port Bienville site Phase I ESA was completed in March 2008 and an addendum done in September 2009.

The Phase I ESA for the approved Westbank F borrow area, including the area of the proposed access route, was completed on October 10, 2007. Two RECs were noted at the site, which included eight discarded automobile fuel tanks (all tanks appeared empty) and three rusty metal drums containing unknown materials. These RECs were associated with illegal dumping along the gravel road at the east side of the property. The RECs were physically very close to each other and could easily be removed for safe disposal. The contractor recommended that the soil in these areas be sampled and analyzed to ensure that there is no contamination present. The locations of the drums were mapped and are outside of the proposed construction footprint.

Orleans Parish (IERs #18 and #25)

The Phase I ESA for the Maynard site was completed on June 4, 2007. Soil and groundwater sampling was recommended on the western portion of the site because of concerns regarding the Fletrich Transportation Systems facility formerly located near the site. However, sampling was not conducted because the RECs would not be impacted by construction activities.

The Phase I ESA for Cummings North was completed on April 4, 2007. There were potential concerns from illegal solid waste dumping on the western portion of the subject site. There were also potential off-site concerns because of the current and historical use of the Recovery Waste Management facility, which is located southeast of the subject site, across Chef Mentour Highway. The facility is reportedly utilized as a Type II landfill. Additional assessment of the property was recommended.

The Phase I ESA for Stumpf Phase 1 was completed on May 1, 2008. The investigation revealed no current RECs, but one historical REC. The Phase I ESA for Stumpf Phase 2 was completed on May 28, 2008. This assessment has revealed an historical REC from the former Overnight Transport facility adjacent to the west and one REC from the Recovery One Landfill adjacent to the east. The locations of the RECs at the Stumpf Phase I and Phase 2 sites were mapped.

St. Bernard Parish (IER #18)

The Phase I ESA for 910 Bayou Road was completed on April 4, 2007, and concerns were noted due to the former agricultural use of the property, which may have left residues of pesticides or herbicides in the soil. Also, a Phase I ESA for the Dockville site was completed on May 21, 2007. There was evidence of past oil drilling operations on the site. Soil and groundwater sampling was recommended, and the locations of the abandoned drill sites were mapped.

Plaquemines Parish (IERs #18 and #22)

The Phase I ESA for Belle Chasse was completed on June 18, 2007. Three possible RECs were found near the proposed site: (1) historical concerns were noted related to the likely use of herbicides and insecticides on a golf course adjoining the property; (2) concerns were noted concerning former oil drilling operations on the southeastern and western portions of the site; and (3) concerns were noted concerning numerous gas and oil wells located in the Stella Oil and Gas Field, east and southeast of the site. For the RECs noted in (1) and (2), soil and groundwater sampling were recommended; however, sampling will not be conducted for REC (3), as it would not be impacted by construction activities.

The Phase I ESA for Westbank N was completed on January 29, 2008. Several concerns were noted from past drilling operations in the central portion of the site, stained soils observed underneath a backhoe located in the northeastern portion of the site, a downed pole-mounted transformer located in the northeastern portion of the site, several 55-gallon drums and 5-gallon containers observed scattered across the north-central portion of the site (no stains, odors, or dead vegetation were observed around these containers), and an approximately 100-gallon diesel AST observed in the north-central portion of the site. The locations of these RECs were mapped and would be avoided during excavation.

Additional concerns were noted from the reported application of herbicide for at least 10 years over the entire site by the current occupant, and from debris piles in the north-central portion of the site. Concerns were noted from the reported disposal of incinerator ash on the eastern adjoining property and from the former Belle Chasse Landfill facility located approximately 0.25 mile east of the site. The potential off-site RECs are outside of the proposed construction footprint and would not be impacted by excavation activities.

Parishes Outside of HSDRRS Project Area

East Baton Rouge Parish

A Phase I ESA for Lilly Bayou was performed in October 2006. No RECs were identified, except for one active oil well and another well that had been plugged and abandoned. An addendum to the Phase I ESA was performed on January 28, 2009, which confirmed the findings of the 2006 report, and no additional RECs were found. No additional investigation of HTRW is recommended at this site, unless the project location changes. The areas around the two oil wells should be avoided and marked as no-work zones.

Plaquemines Parish (IERS #22, #31, and #32)

The Phase I ESA for the Tabony site was completed on January 29, 2008. Concerns were noted from the former drilling operations of a documented well located in the south-central portion of the site, and a metal pipe of unknown use observed extending from the ground outside the northwest corner of the fenced cell tower (former radio tower) site. The location of the well and pipe were mapped and would be avoided during excavation. Other concerns were noted from two 55-gallon drums and three 5-gallon containers observed stored in the southwestern portion of the site, south of a former home site. No ground contamination was noted, and the drums and containers are outside of the proposed construction footprint. An additional concern was noted from former drilling operations for a documented well located approximately 0.13 mile north of the subject site. The possible off-site RECs are outside of the proposed construction footprint, and would not be impacted by excavation activities.

The Conoco Phillips, Idlewild Stage 1, and Nairn sites, required Phase I ESAs, and various HTRW issues were noted and are discussed in the following sections.

Conoco Phillips Site - The Phase I ESA was completed March 31, 2009. Two RECs were found on the property. The first was composed of leaking drums and containers, miscellaneous unlabelled drums and containers, stained soil, hydrocarbon odor, waste tires, and batteries observed within the equipment storage area at the northeast corner of the property. Releases from the leaking drums and containers may have impacted the subject property. The second consisted of a large number of dead and dying cattle present at the site. While initial observations indicate that many of the cattle were malnourished, all cattle at the property did not exhibit similar physical condition, and some appeared to be healthier than others. Without an expert opinion rendered by a veterinarian or livestock professional, it is impossible to eliminate the possibility that the mortalities were related to some unknown environmental condition at the property. However, a follow-up site visit was performed on September 4, 2009. The drums and containers in the equipment storage area had been removed, and no signs of soil staining or stressed vegetation were seen. Previously documented cattle carcasses had been removed. The deaths of cattle were apparently due to Hurricane Gustav, during which numerous cattle became trapped in thick mud in some of the canals on the property. The remaining cattle appeared healthy, and pasture at the site was of better quality than that seen during the previous site inspection (March 2009). No further investigation of HTRW was recommended.

Idlewild Stage 1 - A Phase I ESA was prepared for the contractor-furnished borrow area on October 29, 2008. Two environmental concerns were found. The first concern is an old petroleum well located near the northwest corner of the Stage 2 site, which is not part of the Stage 1 site. Soil sampling should be conducted in the vicinity of the well if material near the

well is to be used for borrow, and soil sampling for pesticides and high levels of metals within the Stage 1 site was also recommended. Additional Phase II investigation and testing at the Idlewild Stage 1 site was performed on October 30, 2009. Laboratory analysis of 35 shallow groundwater samples and seven soil samples collected on October 27, 2009, indicated that tested parameters were either below the laboratory minimum detection limits or below the respective LDEQ RECAP Industrial Groundwater standards.

Nairn - A Phase I ESA was prepared for the proposed Nairn contractor-furnished borrow area on November 12, 2008. No RECs were found, except for unknown fill material on tract "D". It was recommended that either the area composed of unknown fill material be avoided for use as borrow, or that the material be sampled to determine if the material was suitable for borrow.

Idlewild Stage 2 - Based on the Phase II ESA performed in April of 2007, all soil samples indicated tested parameters that were either below the laboratory minimum detection limits or below the respective LDEQ RECAP Industrial Soil standards for all contaminants, except for arsenic. The USACE recommended that, should the arsenic in the area not meet RECAP Corrective Action Approval, the soil surrounding a former oil well would be remediated to meet Louisiana RECAP standards before being used for borrow material. If remediation is needed, it is the responsibility of the landowner to complete remediation prior to use in any USACE contract, and a USACE HTRW specialist will coordinate with the landowner, as needed, to ensure compliance with environmental standards. If the soil in the area of concern cannot be remediated, the site will not be used for any USACE project.

St. Charles Parish (IERs #18 and #32)

The Phase I ESA for Bonnet Carré North site was completed on July 23, 2007. Three possible RECs were found near the area. Seven pressurized pipelines are in the area for petroleum, butadiene, ethylene, propane, propylene, and butane. As long as the borrow activity does not impact the pipelines, no problems should be anticipated from this source. Several plugged and abandoned oil wells are located on the Spillway property. The locations of these areas were mapped and would be avoided during borrow activities. Concern was noted regarding the possible presence of contaminants in the soil within the floodway because water from the Mississippi River flows over the site during spillway openings, potentially depositing contaminants within the area.

A Phase I ESA was completed on January 26, 1999, for the 3C Riverside property. The report concluded that previous RECs on the property have been cleaned and removed. No current RECs were found. A second Phase I ESA for a portion of the property as a borrow source was evaluated in a Phase I ESA dated July 23, 2007, and no RECs were found. A third Phase I ESA for the 3C Riverside Phase III borrow area was completed on July 24, 2008, and no RECs were found.

4.2.16.2 Impacts of HSDRRS

4.2.16.2.1 HSDRRS 2011 Impacts

Some RECs were identified in the Phase I ESAs within the ROW for the HSDRRS, on adjacent or adjoining properties, and outside, but near, the project areas. All of these RECs were easily remediated or avoided and were unlikely to affect the HSDRRS, personnel working on the project, or the public.

When RECs were found adjacent to the HSDRRS ROW, they were often in areas with litter, trash, white goods (e.g., appliances), or discarded vehicles, and included material such as:

- abandoned or leaking drums and containers (potential used oil, petroleum ASTs),
- abandoned trucks, cars, and tractors,

- leaking transformers (potential PCBs),
- stained soil or gravel (potential petroleum products),
- discarded construction material,
- existing and former boat launches, boat slips, and boat docks (potential petroleum products), or
- other miscellaneous materials.

Contaminant sources, in some cases, were presumed to include historic industrial use of the property, anthropogenic sources, and the movement of contaminants by Hurricanes Rita and Katrina.

If Phase II ESAs were performed, soils, groundwater, or surface water were analyzed for COCs and contaminate levels and were compared to LDEQ RECAP Standards to determine their significance and risk to the project. RECAP addresses risks to human health and the environment posed by the release of chemical constituents. RECAP screening standards represent contaminant concentrations within a specific environmental medium that are protective of human health and the environment (LDEQ 2003).

Because RECs were avoided and the probability of encountering HTRW in the project area was low, no impacts from HTRW were anticipated. If a REC was not avoided, then the non-Federal sponsor was responsible for remediation. If construction revealed the existence of previously unknown HTRW, then work in that area stopped until the risk from HTRW was evaluated and an appropriate response was determined.

In many cases, adjacent RECs were areas that were being used for illegal residential dumping. If these adjacent debris sites remained, these trash or “dump” sites were generally found to be of little concern to the project area. As such, the probability of encountering HTRW in the course of the HSDRRS projects was still low, and direct impacts were not anticipated.

However, in all cases, should evidence of contamination be observed within the HSDRRS ROW or very near the ROW during ground disturbance activities, construction ceased, and removal and cleanup of hazardous materials was required. In addition, if hazardous waste was encountered during the HSDRRS construction, the contamination was managed following RECAP screening and management options.

The potential to create HTRW materials during the construction process is always present. Storage, fueling, and lubrication of equipment and motor vehicles associated with the construction process was conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants, and oil were managed and stored in accordance with all Federal, state, and local laws and regulations. Used lubricants and used oil were stored in marked, corrosion-resistant containers and recycled or disposed in accordance with appropriate requirements. Construction contractors were required to develop a Spill Prevention Control and Countermeasures Plan. Other mitigation measures for the HSDRRS HTRW impacts are discussed in section 5.0.

Specific HSDRRS Risk Reduction Impacts

For those HSDRRS project areas in which special consideration was determined, the impacts are presented in the following discussion. These impacts are discussed by sub-basin or parish, as applicable. As previously mentioned, any contaminated soils excavated were disposed of according to applicable Federal and state laws and regulations. If a REC was not avoided due to construction requirements, the REC was further investigated to confirm the presence or absence of contaminants and actions to avoid potential contaminants. Federal, state, or local coordination was potentially required.

St. Charles Sub-basin (IER #1 and IER Supplemental #1)

Sediment contamination in the portion of Bayou Trepagnier that was potentially impacted by the nearby HSDRRS project had the potential to cause negative impacts on the project and personnel. The cleanup process agreed upon by LDEQ and Motiva Enterprises had not begun and was not expected to be complete before the project began. Therefore, a no-work zone was designated for this area until the site remediation process was completed. No other RECs within the project footprint were located and, based on the avoidance of the Bayou Trepagnier sediments, the probability of encountering HTRW was low, and the direct and indirect impacts from HTRW were negligible.

Orleans East Bank Sub-basin (IERs #5 and #27)

Based on the 2009 sampling event, in conjunction with the numerous Phase I and II ESAs performed at the 17th Street, Orleans Avenue, and London Avenue Canals, the following conditions exist:

- 17th Street Canal - sediments in the canal outlet, in the area where the permanent pump station was constructed, contain low concentrations of lead, PAH, and petroleum.
- Orleans Avenue Canal - sediments in the canal outlet, where the permanent pump station was constructed, contain low levels of benzo(k)fluoranthene, arsenic, barium, chromium, and lead.
- London Avenue Canal - sediments in the canal outlet, where the permanent pump station was constructed, contain low levels of petroleum, arsenic, barium, chromium, and lead contamination.

COCs within the three canal sediments were compared with the RECAP Standards, and no contaminants were detected above the limiting RECAP screening standard(s) for evaluation of the risk to human health and the environment. Based on these comparisons, COC concentrations of low risk were determined to exist in the sediment in each of the canals. Because the USACE planned to avoid all other RECs, the probability of encountering HTRW in the project area was low, and the direct impacts from HTRW were negligible. Temporary indirect impacts on water quality from sediment resuspension during construction were low, but potentially occurred.

New Orleans East Sub-basin (IER #11 Tier 1, Tier 2 Pontchartrain, Tier 2 Borgne)

IER #11 Tier 2 Pontchartrain

Results of four TCLP analyses of composite samples from each side of the bank indicated that the material in each of the investigation areas was classified as non-hazardous for disposal in a proper facility. However, the locations of elevated concentrations required appropriate personal protective equipment and necessary precautions to limit any potential exposures for construction workers during the construction phase.

Based on the Phase I and Phase II ESA reports for the project area, and because the RECs would be avoided during implementation of the HSDRRS action, the probability of encountering HTRW in the project area was low, and the direct and indirect impacts from HTRW were negligible.

IER and IER Supplemental #11 Tier 2 Borgne

Based on the results of the investigation, contaminants had not migrated onto the project site from either the U.S. Filter or BOC facilities. The site does not present an unacceptable risk to construction personnel or to the environment. Further environmental investigation of this site

was not warranted at this time. The probability of encountering HTRW in the project area was low, and the direct and indirect impacts from HTRW were negligible.

Chalmette Loop Sub-basin (IERs #8 and #10)

Two minor spills were reported during construction of the HSDRRS at LPV-144 (IER #8) and LPV-146 (IER #10). Both spills were considered minor and involved biodegradable hydraulic vegetable-based fluid. The spills were cleaned up immediately, and no permanent impacts from HTRW occurred as a result.

During construction of the Bayou Dupre floodgate, creosote timber pilings and adjacent soil were removed and stockpiled at the construction site. Additional HTRW assessment was required and soil sampling and analysis were performed to determine soil disposal options. Eight discrete soil samples and two composite samples were taken from the two soil stockpile locations. Each soil sample was tested for TPH-diesel and oil ranges and semi-volatile organic compounds. The analysis determined that material from one of the soil stockpile locations was suitable to be reused, while the material from the other stockpile location contained elevated diesel petroleum hydrocarbons. Although some of the material could have been disposed of on-site, all the material was disposed of off-site at the River Birch Landfill. Approximately 8,000 cy of earthen material were disposed of at the River Birch Landfill.

Belle Chasse Sub-basin (IER #13)

The HSDRRS project discussed in IER #13 is removed from both the area of the active landfill and the industrial sites along Walker Road, and none of the identified RECs lie within the project footprint. Additionally, sediment testing performed in and along Hero Canal did not indicate any COCs. The probability of encountering HTRW in the project area was low; therefore, no direct or indirect impacts were expected.

During construction of the HSDRRS action described in IER #13, the construction contractors encountered debris during excavation activities that contained stumps, logs, household trash, tires, and miscellaneous material such as plastic pipe and steel cables. USACE Engineering was notified immediately, and a HTRW investigator studied the debris material and determined that no HTRW impacts were caused by leaving the debris *in situ* at the excavation site.

Gretna Algiers Sub-basin (IER #12 and IER Supplemental #12)

The chosen HSDRRS action avoided the most problem-prone areas, and decreased the probability of encountering HTRW during the course of construction. Within the HSDRRS footprint, the probability of encountering a REC was very low; therefore, no direct or indirect impacts were expected.

A spill occurred in Plaquemines Parish at the Planters Pump Station during the HSDRRS construction in February 2011. Approximately 2 gallons of biodegradable hydraulic grade vegetable oil was discharged into the Algiers Canal. The area was protected by an oil boom, and no material was discharged off-site; therefore, water quality was not impacted due to the HTRW release.

Harvey Westwego Sub-basin (IER #14 and IER Supplemental #14.a)

Under the HSDRRS project, HTRW identified in previous site investigations was avoided or removed; therefore, no direct or indirect impacts resulted.

During the HSDRRS construction of work, a spill occurred in Jefferson Parish at the Westwego #2 Pump Station in March 2011. An unknown amount of No. 2 diesel fuel oil was discharged into the Keyhole Canal (a tributary to Bayou Segnette) at the pump station. The leak was secured and reported (National Response Center Incident Report #971473). The amount of fuel discharged was unknown, and the construction contractor secured the leak. Local officials determined that the fuel oil material dispersed, and the impacts on water quality from the HTRW were negligible.

Lake Cataouatche Sub-basin (IER #16 and IER Supplemental #16.a)

Because alignment relocation work occurred around oil and gas transmission pipelines, the potential exists for an unplanned discovery of HTRW materials during construction. If this occurred during construction activities, the work that affected the contaminated materials was stopped and appropriate notification and coordination was completed. Investigations were conducted to characterize the nature and extent of the contamination and establish appropriate resolution. However, under the HSDRRS project, specific HTRW concerns from pipelines were avoided; therefore, no direct or indirect impacts resulted.

HSDRRS Borrow IERs Impacts

Table 4-54 denotes the borrow IERs in which there were RECs (on-site or off-site) associated with the HSDRRS borrow project footprint, sorted by parish. In all cases, the locations of the RECs were mapped and were avoided during construction. As such, the probability of encountering HTRW in the project area was low; therefore, no direct or indirect impacts were expected.

Additionally, the off-site RECs that were outside of the borrow area footprint were also mapped for avoidance, although these RECs were not impacted by excavation. Therefore, the probability of encountering HTRW in the borrow sites was low, and no direct or indirect impacts were expected.

A discussion follows table 4-54 for all borrow sites for which special consideration was determined by the USACE, and the impacts are presented in the discussion section. As previously mentioned, any contaminated soils excavated were disposed of according to applicable Federal and state laws and regulations; and if a REC was not avoided due to construction requirements, the REC was investigated further to confirm the presence or absence of contaminants, and appropriate actions were determined to avoid possible contaminants. Federal, state, or local coordination was potentially required.

Specific Impacts of Borrow Sites Within the HSDRRS Project Area

More borrow sites were environmentally cleared than are needed for HSDRRS 2011 construction. Therefore, in many cases, impacts from borrow material excavation at borrow sites have not occurred, and will likely not occur in the future. All the borrow sites are described, regardless of past or future use status, to provide an overview of all the potential impacts from HSDRRS construction.

Table 4-54. The HSDRRS Borrow IERs with RECs near Project Footprints by Parish

IER* #	Investigation/Date	Findings	Impact Discussion
<i>Jefferson Parish</i>			
18	Phase I ESA June 22, 2007	Three RECs located within the project area	Churchill Farms Pit A - the locations of the RECs were mapped and were avoided.
18	Phase I ESA July 21, 2007	Two RECs located within the project area	Westbank Site G - the locations of the RECs were mapped and would be avoided.
22	Phase I ESA September 11, 2007	On-site and off-site RECs located within or near the project area	Westbank I - the locations of the on-site RECs were mapped and would be avoided. The off-site RECs were outside of the construction footprint, and would not be impacted by excavation.
25	Phase I ESA January 30, 2008	On-site and off-site RECs located within or near the project area	Westbank E - the locations of the on-site RECs were mapped and would be avoided. The off-site RECs were outside of the proposed construction footprint, and would not be impacted by excavation.
28	Phase I ESA October 10, 2007	Two RECs located within or near the project area	Westbank E Access Route - the location of the on-site REC was mapped and would be avoided. The off-site REC could be easily removed and disposed of as necessary prior to construction.
<i>Orleans Parish</i>			
18	Phase I ESA June 4, 2007	Off-site REC located near the project area	Maynard Site – the REC location is off-site and sampling did not occur as construction did not impact the REC.
18	Phase I ESA April 4, 2007	On-site and off-site RECs located within or near the project area	Cummings North - the locations of the on-site REC (illegal dumping of solid waste) was mapped and would be either removed or avoided during construction. The off-site REC, a Type II landfill was outside of the proposed construction footprint, and would not be impacted by excavation.
25	Phase I ESA May 1, 2008	One historical REC located near the project area	Stumpf Phase 1 – the REC location was mapped and is off-site. Construction should not impact the REC.
25	Phase I ESA May 28, 2008	One REC and one historical REC located near the project area	Stumpf Phase 2 – the REC location is off-site and mapped to ensure avoidance. The historical REC was also mapped and is off-site. Construction should not impact the RECs.
<i>St. Bernard Parish</i>			
18	Phase I ESA May 21, 2007	REC located within the project area	Dockville Site – the locations of the past oil drilling operations REC was mapped and would be avoided.
<i>Plaquemines Parish</i>			
18	Phase I ESA June 18, 2007	Three off-site REC located near the project area	Belle Chasse Site – all REC locations were off-site and were mapped for avoidance; although construction should not impact the REC.

Table 4-54, continued

IER* #	Investigation/Date	Findings	Impact Discussion
Parishes Outside of HSDRRS Project Area			
<i>St. Charles Parish</i>			
32	Phase I ESAs January 26, 1999; July 23, 2007; July 24, 2008	No current RECs within the property	3C Riverside property – previous RECs were cleaned and removed per all three Phase I ESAs.
<i>Plaquemines Parish</i>			
22	Phase I ESA January 29, 2008	On-site and off-site RECs located within or near the project area	Tabony Site - the locations of the on-site RECs were mapped and would be avoided. The off-site RECs (drums and containers and former drilling operation) were outside of the proposed construction footprint, and would not be impacted by excavation.
31	Phase II ESA April 7, 2010	On-site REC near former well within project area	Idlewild Stage 2 – arsenic levels near a former well were above LDEQ RECAP Industrial Soil standards. If the soils do not meet RECAP Corrective Action Approval, the soil must be remediated in the area by the landowner, prior to use by the USACE.
32	Phase I ESA November 12, 2008	One REC located within the project area	Nairn Site – no RECs were located on-site except for an unknown fill material at tract “D”. The location was mapped and would be avoided.

* - More than one borrow site could be described in a single IER

Jefferson Parish (IER #25)

The Phase I ESA for Westbank D indicated that the site is located adjacent to the River Birch C&D Landfill. Additionally, a REC indicating a plugged and abandoned gas condensate well, located in the central portion of the site along the western border, was suspected of potential negative impact on the subject site. Soil sampling was recommended at the well site and also at the northwest corner of the site, where leachate from the landfill potentially affected the site. Soil testing would be done before any excavation proceeds. The locations of the RECs were mapped, and the areas would be avoided. Because the RECs would be avoided, the probability of encountering HTRW in the project area would be low and the direct impacts from HTRW would be negligible. Temporary indirect impacts from encountering landfill leachate during construction are low, but may potentially occur. As of July 2011, Westbank D was not utilized for the HSDRRS construction.

St. Bernard Parish (IER #18)

A Phase I ESA identified the borrow site at 910 Bayou Road as a former agricultural property, which may have residues of pesticides or herbicides in the soil. That possibility of residual contamination was a considered REC. Pesticides and herbicides degrade over time, although the subsequent degradation by-product may be more toxic than the parent compound. However, approximately 3 ft of topsoil would be removed by bulldozers during site excavation, so any present pesticides or herbicides, or their degradation products, would not be found in the borrow material. Therefore, the probability of encountering HTRW in the project area is low, and the direct and indirect impacts from HTRW would be negligible. As of July 2011, the 910 Bayou Road borrow site was not utilized for the HSDRRS construction.

Plaquemines Parish (IERs #22 and #31)

The Phase I ESA for Westbank N, which was used for HSDRRS construction, described several on-site RECs. The locations of these RECs were mapped and were avoided during excavation. Additionally, as discussed above for the site at 910 Bayou Road, the Westbank N site also had on-site concerns from the reported application of herbicide for at least 10 years over the entire site by the current occupant. Impacts from this REC were the same as described for the 910 Bayou Road site. Other concerns were indicated from debris piles in the north-central portion of the site. The debris piles were removed before excavation.

Concerns were noted from the reported disposal of incinerator ash on the eastern adjoining property and the former Belle Chasse Landfill facility located approximately 0.25 mile east of the site. Both of these possible RECs were outside of the construction footprint, and would not be impacted by excavation. The probability of encountering HTRW in the borrow project area was low, and the direct and indirect impacts from HTRW would be negligible. As of July 2011, the Belle Chasse borrow site was not utilized for the HSDRRS construction.

A Phase II ESA for the borrow site Idlewild Stage 2, which was used for construction, indicated that soil samples near a former well were above LDEQ RECAP Industrial Soil standards for arsenic. The USACE recommended that if the arsenic in the area did not meet RECAP Corrective Action approval, then the soil surrounding the former oil well should be remediated to meet Louisiana RECAP standards before being used for borrow material. Remediation was the responsibility of the landowner and must be completed prior to use of the soil in any USACE contract. If the soil in the area of concern could not be remediated, the site would not be used for any USACE project. If soil in the area of concern was avoided or remediated, then the probability of encountering HTRW in the remaining project area was low, and the direct impacts from HTRW were negligible.

Specific Impacts of Borrow Sites Outside of the HSDRRS Project Area

East Baton Rouge Parish (IER #31)

A Phase I ESA for Lilly Bayou, which was used for construction, identified one active and one plugged and abandoned oil well. No other RECs were found on the property and no additional investigation of HTRW was recommended at this site. The areas around the two oil wells were avoided and marked as no-work zones. Because the RECs would be avoided, the probability of encountering HTRW in the project area was low, and the direct impacts from HTRW were negligible.

St. Charles Parish (IER #18)

The Phase I ESA for Bonnet Carré North, which was utilized for HSDRRS construction, encountered three nearby possible RECs. The locations of these areas were mapped and were avoided during borrow excavation activities. Some concern was noted regarding the possible presence of contaminants in the soil within the floodway, because water from the Mississippi River flows over the site during spillway openings. However, as described for 910 Bayou Road site impacts described previously, approximately 3 ft of topsoil was removed by bulldozers during site excavation, so metals or other contaminants were not found in the borrow material. Therefore, with avoidance, the probability of encountering HTRW in the project area was low, and the direct and indirect impacts from HTRW were negligible.

Plaquemines Parish (IER #32)

Two of the HSDRRS borrow sites for which there were HTRW concerns were the Conoco Phillips and the Idlewild Stage 1 sites. At the Conoco Phillips site there were two potential RECs. The first REC included numerous leaking drums and containers, miscellaneous unlabelled drums and containers, stained soil, hydrocarbon odor, waste tires, and batteries, all observed within the equipment storage area at the northeast corner of the property. Releases from the leaking drums and containers potentially had impacted the subject property. The second potential REC was a large number of dead and dying cattle present at the site. Outstanding HTRW questions were resolved, and there was a low probability of encountering HTRW during the course of this project, and no further investigation of HTRW was recommended. The probability of encountering HTRW in the project area was low, and the direct and indirect impacts from HTRW would be negligible. The Conoco Phillips borrow site was not used for the HSDRRS construction as of July 2011.

Two environmental concerns were found at the Idlewild Stage 1 contractor-furnished borrow area, which was used for construction. Additional Phase II investigation and testing was done at the Idlewild Stage 1 site in October 2009, and it was determined that contaminant levels were either below the laboratory minimum detection limits or below the respective LDEQ Industrial Groundwater RECAP standards. No further HTRW study was recommended. Therefore, the probability of encountering HTRW in the project area was low, and the direct and indirect impacts from HTRW were negligible.

4.2.16.2.2 HSDRRS 2057 Impacts

If future levee lifts occur within existing ROWs, any REC previously identified in the Phase I ESAs for levee construction would be reflected in the project documents. As such, any RECs previously identified could be remediated or avoided and would be unlikely to affect future HSDRRS work, personnel working on the project, or the public. However, new Phase I ESAs would be required within 6 months prior to the start of any of the levee lifts to ensure that no additional RECs were found. The probability of encountering HTRW in the project area would be low and RECs would be avoided or remediated; therefore, no direct or indirect impacts would be expected.

Should new borrow sites be needed for future levee lifts, these sites would need environmental compliance to ensure that no RECs or HTRW issues would be encountered at these borrow sites. Therefore, although the location and number of new borrow sites are unknown, no direct or indirect impacts would be expected from HTRW.

For both borrow site excavation and levee lift construction, spills and the potential to produce HTRW are a possibility. Storage, fueling, and lubrication of equipment and motor vehicles associated with construction activities would be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants, and oil would be managed and stored in accordance with all Federal, state, and local laws and regulations. Used lubricants and used oil would be stored in marked, corrosion-resistant containers and recycled or disposed in accordance with appropriate requirements. Construction contractors would be required to develop a Spill Prevention Control and Countermeasures Plan.

4.2.16.3 Cumulative Impacts

4.2.16.3.1 Cumulative Impacts of HSDRRS 2011 and HSDRRS 2057

The potential to create HTRW materials during construction activities is always present. The appropriate manner for minimizing HTRW would be as previously discussed in the HSDRRS projects impacts. These measures would limit impacts from HTRW. The USACE, the local non-Federal sponsor, and their contractors would adhere to these mitigation measures regarding, storage, fuel and oil usage, and disposal. Therefore, no HTRW direct or indirect cumulative impacts would be expected.

Flooding in residential and commercial areas often results in the mixing of surface waters with sewage, contamination of drinking water supplies, and mobilization of HTRW. As floodwaters recede, these constituents all enter surface waters, causing temporary reductions in surface water quality, and could cause soil and sediment contamination within the project area. A reduced risk of flooding and storm damage afforded by the HSDRRS would offer long-term beneficial HTRW impacts by lessening risk of storm surge devastation in the region.

4.2.16.3.2 Cumulative Impacts of Present and Future Regional Actions

Ongoing and future regional projects would likely contribute to cumulative beneficial impacts on HTRW, since many projects in the area, which include ecosystem restoration, infrastructure improvements, and a large storm rebuilding and reconstruction effort, would identify, evaluate, and potentially remediate existing HTRW issues. However, storm reconstruction, redevelopment, and transportation projects could also temporarily adversely impact natural resources, such as water quality in surface waters, because of the mobilization of HTRW due to stormwater runoff from construction sites and dredging. The cumulative effects of these projects on HTRW problems would be temporary and minor. Coastal and wetlands restoration, as well as flood risk reduction projects, could potentially cause contaminated sediment resuspension, which would result in adverse direct and indirect HTRW impacts during construction.

Storm Damage Reconstruction

Some storm damage reconstruction projects might have temporary impacts from the disturbance and mobilization of HTRW, due to such things as demolition and other ground-disturbing activities; however, in general, these projects are in existing footprints and, as such, the chance of encountering HTRW would be low. Also, depending on the type of financing procured for these projects, most would require a Phase I ESA, which should minimize or eliminate encountering HTRW within the project footprints.

Community revitalization has been a central focus in rebuilding areas affected by the storm. Stabilization of soils and passive capping of areas by driveways and parking structures can act to limit the mobilization of HTRW, and would have a positive impact on any HTRW concerns.

Redevelopment

Redevelopment projects would have impacts on HTRW similar to storm damage reconstruction projects. Also, like the storm damage reconstruction projects, the redevelopment projects' financing would most likely require a Phase I ESA, which should minimize or eliminate encounters of HTRW within the project footprints. Additionally, should HTRW be encountered at the sites, in many cases stabilization of soils and passive capping of areas by driveways and parking structures could limit the mobilization of HTRW and would have a positive impact on HTRW.

Coastal and Wetlands Restoration

Coastal and wetlands restoration projects, including the restoration and creation of marshes, would have positive impacts on HTRW problems in the HSDRRS project area. Present and future regional coastal and wetlands restoration projects are being proposed or constructed by CWPPRA and other agencies. The marshes and wetlands created would act as contaminant sinks for dissolved HTRW, and would help to remediate HTRW by acting as biological reactors that would enhance degradation of contaminants.

The coastal and wetlands restoration projects are designed to protect the coastline from erosion and improve water resources in the region, although they could have the unintended consequences of causing contaminant sediment resuspension in areas with contaminated sediments. The resuspension of contaminated sediments could cause negative direct and indirect HTRW impacts, both during construction activities and after construction is complete, on biological resources through the uptake of contaminants in the water column.

Flood Risk Reduction Projects

Levee modification along the Mississippi River, the MRGO deep-draft deauthorization, and other flood risk reduction projects could also temporarily affect HTRW in a manner similar to the HSDRRS construction activities. However, as with the HSDRRS, other flood risk reduction infrastructure being built as part of the SELA and NOV projects would not likely affect HTRW because these projects would be rebuilt in areas currently used for flood risk reduction. In addition, Phase I ESAs would be performed, which would identify and minimize HTRW impacts in the project areas. New canals constructed as part of the SELA project could contribute to HTRW mobilization should excavated sediments be contaminated. However, these projects, along with other flood risk reduction projects, would reduce the risk of flooding and storm surge damage throughout the region, which in turn would offer long-term beneficial impacts by reducing the likelihood of discharging pollutants in stormwater. Flooding in residential and commercial areas frequently results in the mixing of surface waters with sewage, contamination of drinking water supplies, and mobilization of HTRW. As floodwaters recede, these constituents enter surface waters, causing temporary reductions in surface water quality, and could cause soil and sediment contamination within the HSDRRS project area. Overall, the construction of flood risk reduction projects would cause direct and indirect beneficial impacts on HTRW.

Transportation

Similar to the impacts described for the HSDRRS construction, there would be temporary adverse effects on HTRW from transportation projects. However, Phase I ESAs would generally be required for all Federal and state funds to be utilized in transportation projects and, as such, would minimize or eliminate encountering HTRW impacts. The IHNC Lock Project identified dredged material not suitable for aquatic disposal. The project will place this material in a confined disposal facility to ensure that there are no HTRW impacts. Other transportation

projects in the area include repairs to city infrastructure. These projects should have minor and temporary effects on HTRW from construction and ground-disturbing activities.

4.2.16.3.3 Summary of All Cumulative Impacts for HTRW

The cumulative effects of all types of regional projects on HTRW would be temporary and minor and primarily during construction activities. Implementation of Federal, state, and local laws and regulations would minimize any potential HTRW impacts. Therefore, no long-term HTRW direct or indirect cumulative impacts would be expected within the HSDRRS project area.

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SECTION 5.0
HSDRRS MITIGATION



5.0 HSDRRS MITIGATION

Mitigation measures and environmental design considerations were described in each of the IERs and IER Supplementals completed by November 15, 2010. Many of these measures were included in the contracts with construction contractors, and some of the measures were implemented directly by CEMVN. Over 133 contracts were awarded for the HSDRRS efforts. A summary listing of the contracts awarded, the amount originally awarded, and the start and completion dates for a particular portion of the HSDRRS can be found in appendix H.

5.1 OVERVIEW

It is the USACE's policy to work diligently to reduce impacts on the human and natural environment through avoidance, minimization, rectification, reduction, and/or compensation. Although efforts were made during the HSDRRS planning and implementation to avoid impacts, some of the HSDRRS impacts on resources, both human and natural, were unavoidable. This section describes how the implementation of the USACE mitigation process has, and will continue to, reduce impacts on resources in the HSDRRS project area while providing the new 100-year level of risk reduction authorized by the Administration and the Congress through P L 109-234 (4th Supplemental); P L 110-28 (5th Supplemental); P L 110-252 (6th Supplemental), and P L 110-329 (7th Supplemental).

CEQ Regulations for Implementing the NEPA state that mitigation consists of:

- (1) *avoiding* the impact altogether by not taking a certain action or parts of an action.
- (2) *minimizing* impacts by limiting the degree or magnitude of the action and its implementation.
- (3) *rectifying* the impact by repairing, rehabilitating, or restoring the affected environment.
- (4) *reducing* or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- (5) *compensating* for the impact by replacing or providing substitute resources or environments (40 CFR §1500-1508).

Federal laws such as the CWA require wetland impacts to be avoided to the maximum extent practicable and, if impacts are unavoidable, impacts are to be minimized and mitigated. However, in the IERs, the term "mitigation" was typically used to mean compensation for unavoidable adverse impacts on natural resources, specifically wetlands and non-jurisdictional BLH. As described previously, other natural, physical, and human resources were impacted by the construction of the HSDRRS. Through "environmental design commitments," or EDCs, USACE reduced or eliminated some of these impacts. USACE also attempted to "avoid, minimize, rectify, reduce, or compensate" for impacts on other resources (i.e., noise, air quality, cultural resources, water quality, transportation). SWPPPs and NPDES permits contain mitigation measures designed to reduce impacts on water quality; these mitigation measures are based on the CWA regulations. Additionally, Section 106 of the NHPA requires agencies to avoid, minimize, or mitigate (through testing and data recovery) impacts on cultural resources. In the CED, all mitigation efforts, including those defined as EDCs in the IERs, are discussed as mitigation; however, all mitigation for wetlands and non-jurisdictional BLH will be referred to as "compensatory mitigation" or "wetlands and non-jurisdictional BLH" mitigation.

Mitigation for adverse impacts on human and natural resources was developed in a concerted effort to reduce the impacts from the HSDRRS. Many of these mitigation efforts are BMPs

utilized as standard construction practices and fully implemented for the HSDRRS construction. Other mitigation measures were specific to a reach or a project of the HSDRRS. Often, these mitigation efforts were stipulated in the construction contractor's scope of work or P&S. The mitigation measures for all other human, natural, and physical resources were developed in coordination with or recommended by Federal and/or state agencies and are in accordance with applicable laws, regulations, and EOs. Although the USACE concurred with the majority of the Federal and state agency recommendations, some were only partially adopted. All mitigation measures were implemented during design and construction activities or will be implemented in the future for levee lifts and maintenance activities.

The CEMVN project team members incorporated mitigation measures into design and construction to the extent practicable, and focused on mitigation measures to address issues and concerns raised by resource agencies during the NEPA Alternative Arrangements process. Additionally, mitigation measures were evaluated for their potential to impact future operation and maintenance of the HSDRRS. However, most mitigation measures evaluated and implemented during HSDRRS construction will also be implemented during future HSDRRS levee lifts to reduce the level of construction impacts.

5.2 COMPENSATORY MITIGATION PROGRAM

Because the HSDRRS had major adverse impacts on wetlands, and the adequate mitigation of wetlands is critical in reducing the direct and cumulative impacts from the HSDRRS construction, the Mitigation Program has been developed to compensate for wetland and non-jurisdictional BLH impacts. The Mitigation Program provides functional mitigation for the HSDRRS impacts on wetlands and non-jurisdictional BLH, and although the mitigation projects generally will not occur at or proximate to the locations of the impacts, the mitigation effort will fully compensate for the HSDRRS impacts. The overall objective of wetland and non-jurisdictional BLH mitigation is to replace the functions and values of these lost habitats. The Mitigation Program allows input from other resource agencies, the local sponsor, and the public in the decision-making process for mitigation sites and the design and planning of habitat restoration, creation, and enhancement projects.

Early in the HSDRRS scoping process, it was estimated that there was the potential for over 4,000 acres of unavoidable wetland and non-jurisdictional BLH impacts for which compensatory mitigation would be required. The Mitigation Program team is developing large-scale compensatory mitigation plans both east and west of the Mississippi River in the vicinity of the Greater New Orleans Metropolitan Area for the Mitigation Program. Mitigation is being developed in cooperation with environmental resource agencies and the HSDRRS non-Federal sponsors. The Mitigation Program will compensate for four habitat categories impacted during the development of the 100-year risk reduction system: wet and dry BLH forests, swamps, and marshlands. All jurisdictional wetlands and non-jurisdictional BLH forest impacts were assessed in cooperation with an interagency mitigation team under the NEPA, the CWA, the Fish and Wildlife Coordination Act, and Section 906(b) WRDA 1986 requirements.

The goal of the Mitigation Program is to provide compensatory mitigation for unavoidable losses to wetlands and non-jurisdictional BLH impacts that is consistent with relevant laws and policies. Although the compensatory mitigation effort may not be at the site of the actual impact, consistent with Section 2036 of WDRS 2007, a priority has been made to locate any mitigation within the same watershed, to the maximum extent practicable. Under the Mitigation Program, impacts on wetlands and non-jurisdictional BLH generated from the LPV HSDRRS component projects will be mitigated within the Lake Pontchartrain Basin, and the impacts generated from the WBV HSDRRS component will be mitigated in the Barataria Basin, between Bayou Lafourche and the Mississippi River (see section 5.2.2 and Figure 5-1 for the locations of mitigation sites).

5.2.1 Compensatory Mitigation Program Overview

Compensatory mitigation to address adverse effects on fish and wildlife and their habitats was determined in consultation with the Federal and State of Louisiana fish and wildlife agencies in accordance with the Fish and Wildlife Coordination Act of 1958 (48 Stat. 401, as amended; 16 United States Code [USC] 661 et. seq).

Specifically, the goals of the Fish and Wildlife Coordination Act are to:

- prevent loss of and damage to wildlife resources,
- provide for development and improvement of wildlife resources,
- describe damages to wildlife and measures for mitigating,
- consider wildlife conservation and rehabilitation equally with other water resources development programs,
- develop, protect, raise, and stock all species of wildlife, resources thereof, and their habitat, and
- control losses from disease or other causes.

In addition, WRDA 1986 Section 906:

- requires mitigation for the losses to fish and wildlife resources caused by USACE water resources projects,
- requires mitigation to occur prior to or concurrent with construction, and
- requires impacts on BLH to be mitigated in-kind to the extent possible.

Further, under Section 2036(c) of WRDA 2007, it states that "...in carrying out a water resources project that involves wetlands mitigation and that has impacts that occur within the service area of a mitigation bank, the Secretary, where appropriate, shall first consider the use of the mitigation bank if the bank contains sufficient available credits to offset the impact and the bank is approved in accordance with the *Federal Guideline for the Establishment, Use and Operation of Mitigation Banks* or other applicable Federal law (including regulations)..." Section 2036 of WRDA 2007 further states that:

- mitigation of other habitat types is to occur to not less than in-kind conditions to the extent possible,
- mitigation plans are required to be consistent with the standards and policies of the regulatory program, and
- annual consultation with resource agencies and reporting would be required.

Additionally, the USACE (ER 1105-2-100) Planning Guidance Notebook states that mitigation planning must:

- address habitat quantity and quality,
- investigate a range of alternatives,
- consider utilization of project, public, and private lands,
- use incremental cost analysis to identify the least-cost plan, and

- compare and evaluate plans based on four criteria: completeness, effectiveness, efficiency, and acceptability.

5.2.2 Compensatory Mitigation Program Process and Methodology

Within the framework of the Mitigation Program, the first step in the process was identifying the habitats requiring mitigation. Mitigation for impacts on open water habitats and the use of WVA models to evaluate such impacts will follow guidelines developed cooperatively between CEMVN, NMFS, and USFWS (see appendix S). Those guidelines are undergoing further refinement. The USACE anticipates completion of the guidelines prior to the release of any supplement(s) to the CED, and the final version of these guidelines will be included, as appropriate, in forthcoming NEPA documents. In general, mitigation for impacts on open water habitats would typically be limited to the following: any fill that would permanently affect open water habitats classified as EFH or containing SAV; any excavation impact on open water habitats containing SAV, or designated as EFH where excavation would create permanent anoxic conditions in the affected area; any fill or excavation impact on open water habitats containing SAV species which include seagrasses; or, any fill or excavation in open water habitat that is designated as oyster seed grounds by LDWF. However, mitigation for impacts on open water habitats would not typically be required for dredging in open water areas where no SAV is present (even if the affected area is designated as EFH), for filling of an open water area such that the area would not be converted to non-aquatic habitat, or where the impact on open water habitats would be less than 1 acre within a single open water area. Interspersed open waters within and adjacent to wetland habitats were assessed along with marsh impacts using the WVA methodology. Through consultation with NMFS and USFWS, it was determined that mitigation would be required for impacts on all wetland and non-jurisdictional BLH habitats.

5.2.2.1 Process

For the Mitigation Program to be successful, the CEMVN has made it a priority to continue collaborative engagement with Federal and state agencies throughout the process while ensuring that the public is fully engaged and that the Program remains within established cost parameters. To achieve this, the CEMVN will:

- develop and implement compensatory mitigation plans for unavoidable habitat losses associated with the HSDRRS;
- develop the compensatory mitigation plans with input from Federal and state resource agencies and other stakeholders;
- consider large-scale projects, and consider areas identified in the State Master Plan consistent with relevant laws and policies;
- ensure that compensatory mitigation projects will be:
 - implemented as soon as possible after impacts have been determined;
 - located within the same watershed as the unavoidable losses and where they are most likely to successfully replace lost functions and values; and
 - be self-sustaining once ecological success criteria are met to the maximum extent practicable; and
- develop a fully integrated plan that effectively communicates the mitigation process to the public to allow all stakeholders to be engaged and updated.

As required by laws, regulations, and guidelines, all jurisdictional wetlands, BLH, and non-jurisdictional BLH will be mitigated. Efforts will include compensatory mitigation required not only for the HSDRRS, but also for the HSDRRS borrow sites.

Where use of a contractor-furnished borrow site involved impacts on BLH, documentation of proof of purchase of mitigation credits from a mitigation bank was required. Approved mitigation banks were identified within the watershed that could be used for mitigation credits required to mitigate for the habitat destroyed. Proof of purchase of the mitigation bank credits was submitted to CEMVN. As of September 2011, impacts on approximately 117.15 acres (65.97 AAHUs) of non-jurisdictional BLH forest were mitigated to compensate for excavation of contractor-furnished borrow areas.

Current compensatory mitigation requirements are found in the most recent wetlands and non-jurisdictional BLH mitigation table, and this table is included in appendix N. However, because HSDRRS construction is ongoing and mitigation credits are purchased for impacts on non-jurisdictional BLH at contractor-furnished borrow sites, the final compensatory mitigation requirements are likely to change. These changes will be documented in the Mitigation IERs, and in any future supplements to the CED. Many of the environmentally cleared borrow sites may not be used for the remaining HSDRRS construction. Therefore, non-jurisdictional BLH impacts and associated mitigation may be substantially less than predicted by the IERs.

5.2.2.2 Methodology

The Mitigation Program team set initial screening criteria for both the LPV and WBV components of the HSDRRS compensatory mitigation. The criteria for the wetlands and non-jurisdictional BLH mitigation are:

- comply with environmental laws, regulations, and policies (i.e., WRDA, CWA, USACE guidance);
- determine any HTRW risk;
- locate within LPV or WBV mitigation basin, to the greatest extent practicable;
- replace in kind (replace impact AAHUs by habitat type);
- determine technical viability (e.g., depth of water, salinity lines);
- screen out projects that are potential future protection or restoration projects (e.g., authorized but not funded);
- have independent utility (not dependent on the completion of other projects);
- can be scaled to meet mitigation requirements only;
- no stand-alone BLH-dry projects (BLH-dry requirements will be mitigated contiguous with mitigation for other habitat types) or stand-alone marsh nourishment projects;
- BLH-dry, BLH-wet, and swamp projects must be contiguous with an existing resource-managed area;
- flood-side mitigation projects must be part of projects that consist of multiple habitat types unless contiguous with another resource-managed area;
- must meet 100 percent of the mitigation requirements for the impacted resources-managed land use type (e.g., impacts on wetlands located in JLNHPP must be mitigated in JLNHPP) and for the specific impacted habitat types (e.g., impacts on BLH must be mitigated by restoration or creation of BLH).

In addition, the Mitigation Program team also made several key assumptions in order to move forward with compensatory mitigation feature screening. These assumptions were:

- fresh and intermediate marsh AAHUs would be mitigated together as either fresh or intermediate marsh habitat,
- combine flood side and protected side BLH-dry impacts and mitigate as BLH-dry or BLH-wet habitat on either the flood side or protected side of areas, and
- BLH-dry could be mitigated as BLH-wet.

Impacts on wetlands and non-jurisdictional BLH from the construction of the HSDRRS were analyzed using the WVA methodology. The WVA methodology is a quantitative, habitat-based assessment tool originally developed for use in determining wetland benefits of proposed projects submitted for funding under the CWPPRA. It is widely used to evaluate the impacts of coastal projects on wetland values. The results of the WVA, measured in AAHUs, provide an estimate of the positive or negative environmental effects of a potential project. More details on the WVA methodology can be found in section 4.2.3.2.

A number of public meetings were held to engage and inform the public of the HSDRRS impacts on wetlands and non-jurisdictional BLH and gather input from the public regarding the Mitigation Program. The first of these public meetings was a series of listening sessions in August 2009, followed by a series of wetlands and non-jurisdictional BLH mitigation meetings in May 2010. Specifically, community members were provided the opportunity to suggest specific ways impacts on the region's wetlands and non-jurisdictional BLH systems could be alleviated. Each of these listening sessions and meetings began with a presentation on the nearby HSDRRS construction projects followed by a brief overview of the Mitigation Program. After each presentation, the floor was opened to questions, suggestions, and ideas from the public regarding where, and how best, to mitigate for wetland and non-jurisdictional BLH impacts. Ideas for projects considered for the compensatory mitigation will be documented in two Mitigation IERs, which will be available for public review and comment once prepared. Ongoing development of mitigation measures would include regular progress updates to the public.

All compensatory mitigation activities will be consistent with standards and policies established in the CWA Section 404 regulatory program and the appropriate USACE policies and regulations governing compensatory mitigation.

Two programmatic mitigation IERs will be prepared; one for each mitigation basin:

- LPV Mitigation Basin on the east side of the Mississippi River, and
- WBV Mitigation Basin on the west side of the Mississippi River.

The anticipated date for the completion of the programmatic mitigation IERs (IERs #36 and 37) is December 2013. After the mitigation IERs are completed and the Decision Records are signed, the design phase of the mitigation projects will begin. During the design phase, the CEMVN will start the real estate acquisition of the mitigation lands. It is anticipated that the first construction contract for the Mitigation Program will be issued in 2014. After construction of each functional portion is complete (estimated to be 2017), the non-Federal sponsor will be responsible for operation and maintenance.

Approximately 400 potential sites in each mitigation watershed were identified as potential compensatory mitigation projects. All potential mitigation sites go through initial screening by the mitigation team. The potential mitigation projects include mitigation banks, and others

developed by the mitigation team. Figure 5-1 indicates the potential HSDRRS compensatory mitigation projects' boundaries that are currently being evaluated by the mitigation team.

5.3 THE HSDRRS DESIGN AND CONSTRUCTION MITIGATION AND FUTURE MITIGATION

Mitigation measures have been implemented to reduce the impacts of the HSDRRS construction and features, including activities such as environmental design measures and BMPs. These mitigation measures were typically coordinated with appropriate Federal and state resource agencies, and were documented in the Decision Record for each IER. In some specific instances, additional mitigation measures were identified after IER completion but were implemented during construction activities. All mitigation measures are described below by HSDRRS project component, and the description includes the originally proposed mitigation measures and information on what mitigation measures were implemented during construction activities.

General design and construction mitigation efforts are discussed for risk reduction construction and borrow sites, followed by specific design and construction measures by resource.

5.3.1 Design and Construction Mitigation

In many cases, the risk reduction and borrow IERs described similar mitigation measures, which addressed efforts to minimize the impacts on nesting birds, threatened and endangered species, cultural resources, noise, dust, and water quality. These mitigation measures were typically implemented during construction, or during the time indicated in the Decision Record. At times, these measures involved the restriction of construction activities during certain times of the year (i.e., nesting periods), maintaining a buffer from the sensitive resources of a specified acceptable distance (i.e., 330 ft from active nests), monitoring (i.e., biologist, archaeologist, or other personnel skilled in surveillance for a particular resource concern), or contract specification language that alerted the contractor of the potential that an environmental or cultural resource could be uncovered in the project area during construction activities, which would trigger reporting and other potential requirements. The following mitigation measures, which dealt with these coordination efforts, minimized the impacts from the HSDRRS projects and were standard practices for many risk reduction construction projects.

5.3.1.1 Design and Construction Coordination for the HSDRRS Projects

The CEMVN coordinated with the USFWS to implement the recommendations identified in the USFWS Final CAR for each specific risk reduction project to satisfy the Fish and Wildlife Coordination Act (see CED section 7.0 Compliance with Environmental Laws and Regulations). If the HSDRRS project component was not constructed within 1 year or if changes were made to the project, the CEMVN would reinitiate consultation with the USFWS to ensure that the HSDRRS project would not adversely affect any Federally listed threatened or endangered species or their habitat.

The USFWS was provided an opportunity to review and submit recommendations on the draft plans and specifications for all the HSDRRS components addressed in the IERs. Additionally, any proposed change in levee, floodwall, floodgates, ramps, breakwaters, drainage structure features, locations, or plans, especially those that impacted wetlands or fish and wildlife habitat (including open water), were coordinated in advance with the USFWS, NMFS, LDWF, and LDNR.

Mitigation components are considered a feature of the project. The non-Federal sponsor is responsible for the Operational, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) of all project features in accordance with the PPA and the OMRR&R manual, which the CEMVN provides upon completion of the HSDRRS.

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Figure 5-1: HSDRRS Wetland Compensatory Mitigation Sites Being Evaluated

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5.3.1.3.1 Orleans East Bank Sub-basin (IER #5)

The solicitation package for procuring the design-build proposals for the HSDRRS project described by IER #5 included a number of design considerations intended to avoid or minimize the impacts of the project. These design parameters, listed below, would require the specific HSDRRS project to:

- Minimize impacts on the overall footprint
- Minimize impacts on wetlands and natural hydrological regime
- Maintain a water flow capacity that is comparable to the canal's capacity prior to construction
- Avoid or minimize disturbance of contaminated sediments and other HTRW in the project area if they are found to be present
- Minimize impacts on recreation and greenspace
- Construct the pump stations, demolish the existing ICS and operate the stations so that they will conform to the noise and vibration limitations of the New Orleans Municipal Code for Sound Attenuation (mitigation measures could be required to reduce noise impacts to acceptable levels and comply with the local noise ordinance, if necessary)
- Minimize the heights of structures associated with the pump station, so that they do not exceed a height of 45 ft
- Return temporary construction easements to pre-construction conditions and consistent with the new 100-year level of risk reduction
- Design all project features so that the visual and human-cultural values associated with the project would be protected, preserved, maintained, or enhanced to the maximum extent practicable (structures would be designed to blend with their physical surroundings, or where contrast is necessary and appropriate, that contrast would improve the environment to the greatest extent practicable)

5.3.1.3.2 Chalmette Loop Sub-basin (IERs #8, #9 and #10)

Structures in the Chalmette Loop sub-basin would be required to meet the following conditions:

- The cross-section of the structures should be designed to pass flows from the proposed Violet Diversion to the unprotected-levee side.
- The flood risk reduction water control structures should maintain pre-project cross-section in width and depth to the maximum extent practicable.
- If the flood risk reduction water control structures do not maintain the pre-project cross-section, those structures should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.

- The flood risk reduction water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.
- To enhance organism passage, the flood risk reduction structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert. Various ramp designs should be considered.

5.3.1.3.3 Lake Cataouatche Sub-basin (IERs #15 and #17)

The expansion of all levees within the IERs #15 and #17 HSDRRS project should be towards the protected side, wherever feasible.

5.3.1.2 HSDRRS Borrow General and Specific Design and Construction Mitigation

5.3.1.2.1 HSDRRS Borrow General Design and Construction Mitigation

A protocol was utilized, as provided by the USFWS in an August 7, 2006 planning aid letter, to identify and prioritize borrow sources, thereby minimizing impacts on fish and wildlife resources. The USFWS recommends that, prior to utilizing borrow sites, every effort should be made to reduce impacts by using sheet pile and/or floodwalls to increase levee heights, wherever feasible. In addition, the USFWS recommends that the following protocol be adopted and utilized to identify borrow sources in descending order of priority:

1. Sites that are permitted commercial sources, authorized borrow sources for which environmental clearance and wetland and non-jurisdictional mitigation have been completed, or non-functional levees after newly constructed adjacent levees would be providing equal risk reduction.
2. Areas under forced drainage that are protected from flooding by levees, and that are:
 - a) non-forested (e.g., pastures, fallow fields, abandoned orchards, former urban areas) and non-wetlands;
 - b) wetland forests dominated by exotic tree species (i.e., tallow) or non-forested wetlands (e.g., wet pastures), excluding marshes; and
 - c) disturbed wetlands (e.g., hydrologically altered, artificially impounded).
3. Sites that are outside a forced drainage system and levees, and that are:
 - a) non-forested (e.g., pastures fallow fields, abandoned orchards, former urban areas) and non-wetlands;
 - b) wetland forests dominated by exotic tree species (i.e., tallow) or non-forested wetlands (e.g., wet pastures), excluding marshes; and
 - c) disturbed wetlands (e.g., hydrologically altered, artificially impounded).

The USFWS offered the following additional recommendations for reducing borrow site impacts on fish and wildlife resources and, where feasible, enhancing those resources. However, these additional recommendations should not be implemented if they would result in the expansion of existing borrow pits or construction of new borrow pits in wetlands or non-jurisdictional BLH.

1. A minimum of 30 percent of the borrow pit's edge should slope no greater than 5 horizontal (H):1 vertical (V), starting from the water line down to a depth of approximately 5 ft.

2. Most of the woody vegetation removed during clearing and grubbing should be placed into the deepest parts of the borrow pits and the remaining debris should be placed in the water along the borrow pit shorelines, excluding those areas where the 5H:1V slope, per recommendation 1, have been constructed.
3. Following construction, perimeter levees (if constructed) around each borrow pit should be gapped at 25 ft intervals with an 8 ft wide breach, the bottom elevation of which should be level with the adjacent natural ground elevation.
4. When avoidance and minimization of non-jurisdictional BLH and wetland impacts is not practicable, all unavoidable net losses of those habitats should be fully offset via compensatory mitigation. Such compensatory mitigation should be sited within the watershed and/or hydrologic unit where the impact occurred, and should be completed concurrently with borrow operations, or as soon thereafter as practicable.

Additionally, the borrow IERs also contained the following mitigation efforts, which pertain to the borrow pit design. These were common mitigation measures for many of the borrow IERs and are listed below:

- Government-furnished borrow areas will be potentially designed and constructed with gradual side slopes, irregular shapes, and some islands, and, where practical, vegetation will be allowed to serve as its backdrop. Specific design guidelines for these borrow areas are found in the USACE Report 4.
- Although several borrow IERs (e.g., IERs #18, #19, #22, #25, #26) stated that USACE-directed landscaping will occur at all borrow sites, many of these borrow sites are located on private property. Because the construction contractor enters into an agreement directly with the borrow site landowner or operator, the Federal government is not a party to those contracts and does not require the borrow site landowners to reuse their sites in a particular manner or to fence their borrow sites.
- Ideally, the proposed borrow sites would be designed and constructed with gradual side slopes, irregular shapes, and have some island, and where practicable, vegetation should be allowed to serve as visual screening. Specific design guidelines for these borrow sites are found in *Part V of Environmental Design Considerations for Main Stem Levee Borrow Areas Along the Mississippi River, Lower Mississippi River Environmental Program, Report 4, April 1986*. Where it is not feasible to develop these proposed borrow sites using positive environmental design features, measures such as landscaping could be utilized to screen off negative viewsheds into borrow sites.
- Coordination with USFWS is ongoing to implement the recommendations laid out in the borrow selection Planning-Aid Letter (dated August 7, 2006), programmatic CAR (dated November 26, 2007), and each IER specific Final CARs (various dates). However, all borrow sites must comply with parish and county or other local ordinances. Specifically, the Jefferson Parish Ordinances (Ordinance Number 20763, S 3(VI(2)), 9-22-99; Ordinance Number 22962, S 3, 1-10-07) restrict the distance borrow pits can be located from residential structures or subdivision boundaries and also require that borrow sites be backfilled at the end of their use. For the government-furnished borrow sites, Westbank D, E, F, and I analyzed in IERs #22 and 25, the Federal government has not moved forward requesting acquisition of the site from the non-Federal sponsor.

The HSDRRS borrow sites were located in areas that minimized and avoided impacts on wetlands to the greatest extent practicable. The CEMVN Regulatory Functions Branch delineated jurisdictional wetlands during initial investigations of potential borrow areas.

Jurisdictional wetlands areas were avoided if the site was used as a source for suitable borrow material. At times, due to these delineations, proposed borrow sites were eliminated from further consideration or the borrow area management plans for a particular site were revised to avoid jurisdictional wetlands areas.

5.3.1.3 Water Quality Design and Construction Mitigation for HSDRRS Impacts

5.3.1.3.1 St. Charles Sub-basin (IER #1 and IER Supplemental #1)

Environmentally acceptable construction practices will be used during construction activities to avoid excessive disturbance of soils present in the project area, including the use of mechanized dredging for all dredging activities.

5.3.1.3.2 Jefferson East Bank Sub-basin (IERs #2, #3, IER Supplemental #2, and IER Supplemental #3.a)

Turbidity levels associated with dredging of flotation access channels will be minimized by the use of a bucket dredge, and would be further reduced by the movement of the tides and by wind-induced water turbulence (IER #3). The stockpile site east of the Causeway Bridge would be encircled on all sides except the side closest to the access channel by a silt curtain in an effort to contain the dredged material, to the maximum extent practicable. All stockpiled access and flotation channel material would be returned to its original location upon project completion.

The USFWS recommended backfilling of all access channels in Lake Pontchartrain after construction is complete. In order to have sufficient material to backfill the access channels and minimize turbidity in the lake, the USFWS also recommended the use of silt curtains. However, it was determined during project design that silt curtains will be used to contain material in the stockpile site only if deemed effective and maintainable at the time of construction.

5.3.1.3.3 Orleans East Bank Sub-basin (IER #5)

All fill material would be certified by physical testing, chemical analysis, and/or manufacturer's certification. It would be free from contamination before use. All material would be placed by trained contractors using the appropriate equipment to minimize impacts, and equipment would be properly maintained. The footprints and locations of the structures would be selected to minimize impacts. All excavated material would be temporarily staged within the project area either on land or on barge, and would be tested for proper disposal, or material would be backfilled if test results indicated they were acceptable for aqueous placement.

5.3.1.3.4 New Orleans East Sub-basin (IERs #6, 7, 11 Tier 2 Pontchartrain and 11 Tier 2 Borgne, IER Supplemental #6, IER Supplemental #7, and IER Supplemental #11 Tier 2 Borgne)

Type III turbidity curtains and sediment booms would be used during dredging activities to prevent the escape of resuspended material from the storage sites (IER #6). Since foreshore repairs and construction were not implemented during the HSDRRS 2011 construction, dredging was not performed. However, if foreshore construction occurs as part of future construction, turbidity control measures would be implemented. Post-construction earthen levees would be revegetated to reduce erosion and scour on the flood and protected sides of critical portions of the levees and floodwalls (IERs #6 and #7).

As detailed in IER #11 Tier 2 Pontchartrain, design and construction of the risk reduction project would meet the following criteria:

- The flood risk reduction water control structures in any watercourse should maintain pre-project cross-section in width and depth to the maximum extent practicable, especially structures located in tidal passes.
- The structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered to accomplish this recommendation.
- The structures should be designed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 fps, to the maximum extent practicable. This may not necessarily be applicable to tidal passes or other similar major exchange points. Because the IHNC is a major exchange point in which velocities of ebb tides already exceed 2.6 fps, the structure was designed to maintain approximately the historic velocities through this area, and future activities should not cause an increase in this velocity.
- The water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.
- The shoreline protection features should be constructed as proposed to maintain the shoreline integrity and minimize shoreline erosion.

The following mitigation measures would be used during the risk reduction project construction (IER #11 Tier 2 Pontchartrain):

- To avoid the movement of sediments north into Lake Pontchartrain the USFWS recommended that the coffer dam be constructed only during a slack tide. Instead of timing construction activities around a slack tide, and starting and stopping work, a rock dike was constructed across the IHNC to provide the same benefit of preventing flow and turbidity plumes caused by coffer dam construction from moving into Lake Pontchartrain. Turbidity was monitored during rock dike and coffer dam construction to ensure that construction-generated turbidity was not significantly higher than ambient turbidity in Lake Pontchartrain.
- When practicable, under the flows experienced in the project area, the contractor would install and maintain a Type III silt barrier/curtain at a distance not to exceed 500 ft upstream and downstream of the point of discharge. However, it was reported by the contractor that this was not performed during construction because it was not feasible with the current flows through Seabrook. Instead, a rock dike was constructed to slow velocities during construction.
- The contractor would be required to take three readings per work day with a turbidity meter at locations not to exceed 500 ft upstream and downstream from the point of discharge to ensure that at no time would a difference in turbidity of 50 nephelometric turbidity units (NTUs) be exceeded. This was completed during construction and the thresholds were not exceeded at any time.

IER #11 Tier 2 Borgne required the deposition of dredge material on Bayou Sauvage NWR. For this activity following additional guidelines were to be adhered to in order to avoid adverse impacts on Bayou Sauvage NWR:

- a. Containment dikes should be located in open water areas with minimal marsh disturbance.

- b. Material for containment dikes should be dredged from within the containment area.
- c. Containment dikes should be degraded to marsh elevation following completion of disposal. Mechanical degrading of the containment dikes has not occurred because the dike began to erode naturally. The earthen dikes were colonized by suitable marsh vegetation through natural recruitment; therefore, additional planting was unnecessary.
- d. Dewatering/overflow pipes and breaches should be discharged and directed into degraded marsh for marsh nourishment purposes.
- e. A maximum pump elevation of +4 NGVD with final settling height of +2.5 NGVD should not be exceeded (these elevations may be adjusted based on engineering surveys and calculated settling rates).
- f. All marsh creation material should be tested for contaminants prior to placement, and a contaminant report should be provided to the NWR.
- g. Following degradation of containment dikes, a 20 ft wide vegetated buffer should be planted along the marsh edge. Container-grown oystergrass and smooth cordgrass should be planted within this buffer on 3 ft centers. The earthen containment dikes revegetated with suitable wetland plants species through natural recruitment. Therefore, the installation of container-grown plants was not conducted.
- h. Should 80 percent survival of planted material not be achieved at the end of one growing season, additional plantings may be necessary.

Additionally, per IER #11 Tier 2 Borgne, in general, the HSDRRS structures should exhibit the following design considerations:

- To the maximum extent practicable, the structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 ft/s. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.
- Design water control structures to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.
- Construct shoreline protection features along the eastern shoreline of the maintenance channel and along the western shoreline of the protected side plunge pool to maintain the shoreline integrity and minimize shoreline erosion.
- Install plugs where the channel intersects with natural and man-made waterways to minimize recreational boating access and reduce wave-induced erosion.
- In addition to the recommendations provided in the CAR, four 48-inch flow-through pipes were installed to provide continued water exchange during the Bayou Bienvenue structure construction.

5.3.1.3.5 Chalmette Loop Sub-basin (IERs #8 and #9)

For project construction of features described by IER #8, all fill material would be certified by physical testing, chemical analysis, and/or manufacturer's certification. It would be free from contamination before use in this project. All material would be placed by trained contractors using the appropriate equipment to minimize impacts on wetland areas, and equipment would be

properly maintained. The footprint and location of the structure would be selected to minimize impacts on wetlands. Construction staging areas would be located primarily on the existing levee or on dredged material deposited during construction of the MRGO.

In addition to the recommendations provided in the CAR, a temporary gap between the Bayou Dupre structure and the T-wall tie-in remained in place during construction to allow for continued water exchange at the project site.

Project construction of features described by IER #9 required measures similar to those of IER #8. Additionally, construction staging areas would be located in upland areas adjacent to the construction corridor.

5.3.1.3.6 Belle Chasse Sub-basin (IER #13)

The HSDRRS project work detailed in IER #13 would include the following mitigation measures to reduce impacts on hydraulics and water quality:

- a. Flood risk reduction water control structures in any watercourse should maintain pre-project cross-section in width and depth to the maximum extent practicable.
- b. Water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.
- c. Any flood risk reduction water control structure sited in a canal, bayou, or navigation channel that does not maintain the pre-project cross-section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel, as well as an opening in the center of the channel that extends to the bottom.
- d. To the maximum extent practicable, structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 ft/s. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.
- e. To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.

5.3.1.3.7 Gretna-Algiers Sub-basin (IER #12)

The HSDRRS project work detailed in IER #12 was to include the same mitigation measures that were outlined for IER #13a-e. However, for the IER #12 project, a closure complex would be constructed within the GIWW to allow for navigation and current reduction. This complex would include a 150 ft to 300 ft main channel gate, a 75 ft to 150 ft bypass channel closure gate, and a 20,000+ cfs pump station. Hydrologic modeling, navigation simulation modeling, and engineering design efforts are still under way to determine the exact location of the closure complex. This comment was considered by the USACE during the final engineering and design efforts.

Material removed during project construction (i.e., dredging Algiers Canal, repositioning the WBV levee landward to accommodate the GIWW gate, and dredging along the GIWW bank line to install the flow control structure) should be tested to determine the presence of contaminants and the material's suitability as borrow material for levee construction. The CEMVN should continue to coordinate with the natural resource agencies to determine the best use of that

material (IER #12). The Algiers dredged material has been tested for borrow suitability and contaminant presence, and CEMVN may beneficially use the material within the JLNHPP. The CEMVN will continue to coordinate with the natural resource agencies to determine the best use of the remaining dredged material.

5.3.1.3.8 Harvey-Westwego Sub-basin (IERs #14 and #17)

The material would be required to meet certain criteria to be utilized in levee construction, and would be similar to material utilized in the original levee work. Fill material would be free from contaminants before being used in levee rebuilding projects. All material would be placed by trained contractors using the appropriate equipment to minimize impacts on wetland areas, and equipment would be properly maintained.

The existing levee and floodwall alignment, as described by IER #17, was followed to the maximum extent practicable. In locations where a new alignment was utilized, the overall footprint of disturbance was decreased. The closure gate on the new alignment will only be closed during storm surge, to minimize disruption of water inundation patterns or create standing water or drained areas where fluctuating water levels had been present. All fill material would be free from contamination before use in levee rebuilding projects and certified by physical testing, chemical analysis, and/or manufacturer's certification. Qualified contractors using the appropriate equipment to minimize impacts on wetland areas would place all material at the fill site.

5.3.1.3.9 Lake Cataouatche Sub-basin (IER #15)

The Lake Cataouatche levee improvement project (IER #15) would utilize material that was free from contaminants before use in levee rebuilding projects. All material would be placed by qualified contractors using the appropriate equipment to minimize impacts on wetland areas and equipment would be properly maintained.

5.3.1.4 Water Quality Design and Construction Mitigation for HSDRRS Borrow Impacts

5.3.1.4.1 IERs #18, #19, #25, #26, #28

As detailed in the IERs, the borrow contractor would be required to secure all proper local, state, and Federal permits. The USACE would require that construction BMPs be implemented and would ensure that a Quality Assurance/Quality Control program would be in place to ensure that the BMPs would be followed during the construction phase. Any NPDES permits required would be obtained by the contractor. Stormwater permits would be obtained as per standard operating procedures. Specifically, the following would be required per contract P&S:

- Silt fencing and hay bales would be installed around the perimeter of the borrow areas to control runoff.
- To make optimal use of available material, excavation would begin at one end of the borrow area and be made continuous across the width of the areas to the required borrow depths, to provide surface drainage to the low side of the borrow pit as excavation proceeds.
- Excavation for semi-compacted fill would not be permitted in water, nor shall excavated material be scraped, dragged, or otherwise moved through water. In some cases, the borrow areas may need to be drained with the use of a sump pump.
- Upon abandonment, site restoration would include placing the stockpiled overburden back into the pit and grading the slopes to the specified cross-section figures. Abrupt

changes in grade shall be avoided, and the bottom of the borrow pit shall be left relatively smooth and sloped from one end to the other. Although this mitigation measure was required by many of the borrow IERs, this was not done at any of the contractor-furnished borrow sites, as the USACE cannot dictate these construction methods to private landowners.

- Any excavation below the depths and slopes specified shall be backfilled to the specified permissible excavation line in accordance with construction P & S. Abrupt changes in borrow area alignment shall be avoided, to the greatest extent practicable. Although this mitigation measure was required by many of the borrow IERs, this was not done at any of the contractor-furnished borrow sites, and it did not generally occur at government-furnished borrow sites.

5.3.1.4.2 IER #25

The borrow area management plan of the Stumpf Phase 1 and Phase 2 borrow areas will show a 100 ft vegetated buffer along canals designated as Section 404 jurisdictional waters of the U.S. Canal crossings shall be constructed in such a way to maintain the existing hydrology in the area, and BMPs will be implemented to ensure no indirect impacts on the canals. However, as of July 2011, the Stumpf Phase 1 and Phase 2 borrow areas have not been utilized for the HSDRRS by the CEMVN construction contractors.

5.3.1.4.3 IERs #29, #30, #31, and #32

As detailed in the IERs, the borrow contractor would be required to secure all proper local, state, and Federal permits required for potentially impacting water quality.

5.3.1.5 Wetlands Design and Construction Mitigation for HSDRRS Impacts

As noted in the majority of the IERs where wetlands impacts would occur from risk reduction features, to the greatest extent practicable, the CEMVN would situate risk reduction features so that destruction of wetlands and non-jurisdictional BLH would be avoided or minimized. The CEMVN also would avoid or minimize the enclosure of wetlands with new levee alignments, to the greatest extent practicable. However, when enclosing wetlands was unavoidable the CEMVN would either acquire non-development easements on those wetlands, or maintain hydrologic connections with adjacent, unenclosed wetlands. The USFWS, NMFS, LDWF, and LDNR will be consulted regarding the adequacy of any proposed alternative wetlands and non-jurisdictional BLH mitigation sites.

5.3.1.5.1 St. Charles Sub-basin (IER #1 and IER Supplemental #1)

The CEMVN and the HSDRRS non-Federal sponsor shall provide 193.05 AAHUs to compensate for the unavoidable, project-related loss of forested wetlands. The compensatory mitigation plan developed to offset project-related impacts will be consistent with mitigation requirements of the CWA regulatory program, and would include monitoring, success criteria, and financial assurance components.

Three new access roads were constructed at the Shell pipeline crossing, under I-310, and at the Walker structure. The USFWS recommends that all three access roads only be used during construction and be degraded and replanted with appropriate non-jurisdictional BLH or cypress swamp species after construction activities are complete. Restoration activities will include the use of measures to prevent nutria herbivory, monitoring to document habitat recovery, and the need for further actions. If any of the access roads are not degraded after construction activities are completed, then secondary and cumulative impacts would have to be addressed. For each of the three new access roads, the USFWS recommends the installation of a minimum of 18 to 24 in

culverts every 250 ft when constructing these access roads through wetlands to allow for aquatic organism movement and access. Additional culverts will be installed at stream crossings and drainage features. The culverts will be maintained to ensure that existing flow of surface water is uncompromised.

5.3.1.5.2 Jefferson East Bank Sub-basin (IERs #2, #3, IER Supplemental #2, and IER Supplemental #3.a)

The CEMVN and non-Federal local sponsor shall provide 22.15 AAHUs to compensate for the unavoidable, project-related loss of intermediate marsh and swamp for work presented in IER #2 and IER Supplemental #2.

5.3.1.5.3 New Orleans East Sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain and #11 Tier 2 Borgne, IER Supplemental #6, IER Supplemental #7, and IER Supplemental #11 Tier 2 Borgne)

Per the IER #7, flood risk reduction and ancillary features such as staging areas and access roads were designed and positioned so that destruction of wetlands and non-jurisdictional BLH was avoided or minimized to the greatest extent practicable. The compensatory mitigation for wetland and non-jurisdictional BLH impacts on the Bayou Sauvage NWR will occur on Bayou Sauvage NWR property as detailed in IER #7, and the refuge staff will be allowed to participate in the compensatory mitigation planning.

The CEMVN and the non-Federal sponsor shall obtain 211.70 AAHUs to compensate for the unavoidable, project-related loss of forested and emergent wetlands. The CEMVN will coordinate with refuge personnel during all phases of the project and work with refuge personnel to provide the compensatory mitigation for any loss of forested or emergent wetlands on Bayou Sauvage NWR property.

The USACE will fully compensate for approximately 24.33 AAHUs based on the impacts on wetlands from the construction of the IER #11 Tier 2 Borgne actions.

In order to minimize impacts on wetlands, the project provided for excavated material to be used beneficially, rather than moving it to an excavation disposal site that would have caused non-jurisdictional BLH impacts. Beneficial use of the project-generated dredge material was placed in an approximately 205-acre area comprised of broken marsh and open water on the south bank of the GIWW (IER #11 Tier 2 Borgne). Analysis of pre- and post-placement aerial photography of the area showed a net gain of approximately 14 acres of emergent marsh within the beneficial use area.

The proposed staging areas were also selected based on the least potential for damage to the surrounding habitats. In addition, non-forested upland areas were used for construction staging, where practicable.

Also detailed in IER #11 Tier 2 Borgne and IERS #11 Tier 2 Borgne, the width of the construction and maintenance access channel and the plunge pool will be minimized, to the greatest extent practicable, to reduce direct impacts on estuarine wetlands. However, it was determined that the 250 ft wide construction access channel was the minimum width for the flood-side channel in order to safely construct the project.

Guidance for avoiding and minimizing impacts on existing marsh within the enhancement area detailed in IER #11 Tier 2 Borgne and to adequately offset conversion of water bottoms with successful marsh creation was incorporated into construction design. Should pre- and post-construction surveys indicate that the enhancement area would result in negative impacts,

remediation and/or mitigation will be required. Any HSDRRS water control structure sited in canals, bayous, or a navigation channel that does not maintain the pre-project cross-section will be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel, as well as an opening in the center of the channel that extends to the bottom.

Section 5.3.1.13.1 details the guidelines on the deposition of dredge material within the Bayou Sauvage NWR from IER #11 Tier 2 Borgne construction activities.

5.3.1.5.4 Chalmette Loop Sub-basin (IERs #8, #9, and #10)

Per details of IER #8, the CEMVN shall fully compensate for the unavoidable loss of 0.5 acre of wetland habitat caused by project features. It was determined that it is unlikely that 0.5 acre of wetland and non-jurisdictional wetlands would be destroyed as part of the IER #8 action. This estimate was originally based on proposed work at Bayou Bienvenue, as well as at Bayou Dupre. The estimate for the proposed work at Bayou Dupre was that up to 0.3 acre of estuarine open water and substrate could be permanently impacted. However, the actual permanent impacts were expected to be less than this estimate. Mitigation will occur for habitat lost as determined necessary by the coordinating agencies, but currently no compensatory mitigation is planned for work under IER #8.

Compensation will occur for any unavoidable losses of 5.31 AAHUs of non-jurisdictional BLH, 1.2 AAHUs of fresh marsh, and 0.66 AAHU of wet BLH caused by the project features detailed in IER #9. The CEMVN will fully compensate for any unavoidable losses of 31.66 AAHUs of BLH, and 267.25 AAHUs of fresh, intermediate, and brackish marshes caused by IER #10 project features.

5.3.1.5.5 Belle Chasse Sub-basin (IER #13)

In the project work, the Oakville pump station will be redesigned to pump stormwater into the adjacent forested wetlands as a stormwater treatment measure and to enhance those degraded wetlands. Upon completion of the gravity drain/pump station, daily stormwater will continue to be drained into the Ollie Canal through a concrete box culvert gravity drain. However, it was determined that, during a hurricane event with high water on the flood side of the system, the sluice gate on the gravity drain will be closed to prevent flood side water from backing up into the gravity drain. The interior stormwater will no longer drain by gravity to the Ollie Canal, but will be pumped via the Oakville pump station into the Cypress Swamp. Water will be pumped into the Cypress Swamp in lieu of the Ollie Canal to lessen the burden on the Ollie Canal and Ollie Pump Station. The existing ground elevation of the Cypress Swamp is higher than the drainage ditch on the protected side, making it impossible to discharge stormwater into the Cypress Swamp with a gravity drain. Pumping daily stormwater into the Cypress Swamp instead of discharging it into the Ollie Canal with gravity will require additional effort and expense due to significant increase in operating time of the pumps. Plaquemines Parish and the USACE do not support operating the pump for daily stormwater when the stormwater can continue to be discharged into the Ollie Canal through a gravity drain, similar to pre-construction conditions, without the additional unnecessary expense of operating and maintaining a pump.

With the project described by IER #13, enclosure of wetlands with new levee alignments will be minimized. When enclosing wetlands is unavoidable, non-development easements on those wetlands will be acquired, or hydrologic connections with adjacent, unenclosed wetlands maintained to minimize secondary impacts from development and hydrologic alteration.

Currently, the CEMVN shall fully compensate for any unavoidable losses of BLH habitat (18.59 AAHUs) and swamp habitat (28.87 AAHUs) caused by IER #13 project features.

5.3.1.5.6 Gretna-Algiers Sub-basin (IER #12)

Compensation will occur for approximately 215.50 AAHUs based on the impacts on wetlands and non-jurisdictional BLH from the construction of the IER #12 actions.

All measures were taken to ensure that all HSDRRS features were designed to stay within preexisting ROW before acquiring additional ROW that impacted adjacent wetlands and non-jurisdictional BLH. In addition, the engineering and design of the HSDRRS components incorporated innovative techniques to construct a floodwall along a navigable waterway, and the gate structure was placed within the GIWW as close to the Harvey and Algiers confluence as practicable (considering navigation hazards) to reduce the floodwall length and further reduce environmental impacts in the Bayou aux Carpes CWA Section 404(c) area. Additionally, any unavoidable losses of wetland or non-jurisdictional BLH habitat caused by the IER #12 project features in the Bayou aux Carpes CWA Section 404(c) area (currently projected at 9.6 acres) will be compensated. Any unavoidable adverse impacts within the Bayou aux Carpes CWA Section 404(c) area will be fully mitigated within that area, to the greatest extent practicable, or the adjacent JLNHPP. Project feature augmentations to offset unavoidable adverse impacts on wetland and non-jurisdictional BLH are under investigation and would be implemented to ensure full compensation mitigation for wetland impacts within the Bayou aux Carpes CWA Section 404(c) area (see section 5.3.2.8. for more Bayou Aux Carpes future mitigation measures).

Because of the sensitivity and significance of the Bayou aux Carpes CWA Section 404(c) area, every effort should be made to minimize impacts during construction of the floodwall and navigational gate. Additionally, requirements for mitigation lands in state-managed or Federally managed lands are the same as those detailed for Belle Chasse sub-basin IER #13.

The following mitigation measures would be required:

- The CEMVN should avoid impacts on the Bayou aux Carpes CWA Section 404(c) area, if feasible. If not feasible, the CEMVN should continue coordination with the NPS and USEPA regarding any proposed project feature that may impact that area.
- Construction should be performed from the water side (i.e., Bayou Barataria/GIWW side) rather than from the Bayou aux Carpes CWA Section 404(c) side.
- Construction of the floodwall within the Bayou aux Carpes CWA Section 404(c) area should be constructed within a 100 ft wide corridor from the GIWW into the 404(c) area, impacting as little of the wetland habitat as feasible. No additional area within the Bayou aux Carpes CWA Section 404(c) area was required for the floodwall or any other construction.
- The CEMVN should investigate and utilize innovative techniques to design and build a structure with the narrowest footprint practicable.
- Should existing oil and gas pipeline ROWs require relocation, impacts associated with those relocations should be avoided and minimized to the greatest extent practicable.
- The CEMVN proposed that if it is feasible to complete augmentations to minimize adverse impacts that would potentially occur because of the construction of the WCC alternative, it will complete those augmentations, monitor the area, and apply adaptive management techniques to the area as determined to be needed in cooperation with the resource agencies. Studies are under way in cooperation with the USEPA, NPS, and other resource agencies to determine the best and safest alternatives for augmenting the Bayou aux Carpes CWA Section 404(c) area to avoid or minimize hydrological impacts

that would result from the HSDRRS project. These studies will aid in determining the appropriate locations to gap spoils banks to allow for uniform sheet flow and appropriate water velocities that would resemble natural storm runoff and tidal exchange. Once the studies are complete, the CEMVN, in conjunction with the resources agencies, will determine which features would be constructed (see section 5.3.2.7.1).

- If freshwater input into the Bayou aux Carpes CWA Section 404(c) area via dredged material bank gapping along the southern bank of the Old Estelle Outfall Canal is determined to be beneficial, the Old Estelle Canal flow control structure will be operated in a manner to provide the highest volume of flow and best use of the outflow. In the event that freshwater input would result in adverse impacts, the structure will be operated to allow water to flow directly into the GIWW.
- The CEMVN will develop an assessment report that addresses potential hydrological and ecological impacts on the Bayou aux Carpes CWA Section 404(c) area as a result of the HSDRRS; collect baseline data within the Bayou aux Carpes CWA Section 404(c) area and surrounding waterbodies to inform the impact assessment; and develop a long-term monitoring plan.
- The CEMVN will develop a mitigation plan that specifies on-site mitigation for the 9.6 acres impacted, which will be implemented within the Bayou aux Carpes CWA Section 404(c) area or the adjoining NPS JLNHPP. In addition, to further minimize impacts on the Bayou aux Carpes CWA Section 404(c) area, the CEMVN will minimize the length of the floodwall by moving the GIWW closure complex as close to the Harvey and Algiers canals confluence as practicable (considering navigation hazards). The floodwall footprint will impact an area approximately 4,200 ft in length by 100 ft in width.

5.3.1.5.7 Harvey-Westwego Sub-basin (IER #14)

In the action described by IER #14 in the Harvey-Westwego Sub-basin, the CEMVN should avoid impacts on public lands, if feasible. If not feasible, the CEMVN should establish and continue coordination with agencies managing public lands that may be impacted by a project feature until construction of that feature is complete and prior to any subsequent maintenance. Agencies overseeing the public lands potentially impacted by the IER #14 project features are USFWS Southeast NWR - Refuge Manager for Bayou Sauvage NWR, NPS, and the USEPA. The CEMVN would ensure that impacts and encroachment onto NPS lands are avoided. Unavoidable impacts and encroachments, when permissible by that agency, should be minimized and appropriately mitigated.

The HSDRRS project design utilizes the existing ROW footprint and avoids adverse impacts on JLNHPP and the Bayou aux Carpes CWA Section 404(c) area. The work on the levee and berm on the flood side was restricted to areas within the previous project ROW, and identified as non-jurisdictional. Reach WBV-14e would extend past the existing ROW on the protected side of the levee; therefore, construction activities would not impact the Bayou aux Carpes CWA Section 404(c) area. The WBV-14.c.2 reach would also extend beyond existing ROW into the former CIT Tract (also known as the Bayou Segnette area)/JLNHPP.

Temporary construction fences were placed along the length of the flood-side construction boundaries of the WBV-14.b.2, WBV-14.c.2, and WBV-14.e.2 reaches. The fences were placed to provide physical barriers between the construction work limits and the adjacent cypress swamp, which, in March 2009, was incorporated into the JLNHPP.

In October 2009, a USACE contractor was clearing the 100 ft by 4,200 ft property designated for construction within the Bayou aux Carpes CWA Section 404(c) area. Approved plans called for

creating a 10 ft wide buffer between the USACE-acquired property and the Bayou aux Carpes CWA Section 404(c) area. The contractor did not properly demarcate that buffer boundary and a tree-clearing operator encroached into the Bayou aux Carpes CWA Section 404(c) area. The total area impacted due to the encroachment was 1,750 square ft. The contractor installed a temporary construction fence at the buffer boundary after the encroachment to ensure that no further encroachments would occur during land-clearing operations. Additionally, the USACE contractor responsible for the encroachment agreed to fully mitigate for the 1,750 square ft of BLH that was impacted by planting 65 trees and conducting Chinese tallow removal.

The USACE contractor planted 65 trees common in BLH habitat in the Bayou aux Carpes CWA Section 404(c) area, conducted Chinese tallow removal through herbicide application, revised their construction procedures, improved their employee training program, and completed follow-up monitoring of plantings. Follow-up site visits by the NPS and correspondence with the USEPA consider the plantings and construction mitigation measures to be adequate to compensate for the encroachment, but expressed concerns with the success of Chinese tallow removal. In response to these concerns, the USACE contractor completed a second herbicide application in June 2011.

The status of development of a monitoring plan, monitoring, modeling, and development of augmentations for the Bayou aux Carpes CWA Section 404(c) area is described in section 5.3.2.7.

Mitigation for any impacts on non-jurisdictional BLH or swamps resulting from IER #14 would be mitigated within the project area, specifically on the adjacent JLNHPP. Currently, the CEMVN shall fully mitigate for any unavoidable losses of wetlands (84.19 AAHUs) caused by the project features. To the extent feasible, impacts on Federal lands will be mitigated on Federal lands within the vicinity of IER #14.

5.3.1.5.8 Lake Cataouatche Sub-basin (IERs #15, #16, and #17)

The USACE will fully compensate for approximately 175.21 AAHUs based on the impacts on wetlands and non-jurisdictional BLH from the construction of the HSDRRS projects in the Lake Cataouatche sub-basin. The project design (IER #15) will avoid or minimize the enclosure of wetlands with new levee alignments. The final alignment of the levee overlays the pre-existing alignment to the greatest extent practicable; therefore, no additional wetlands were enclosed by the project features described by IER #15. Based on project designs it has been determined that upon completion of construction as noted in IER #15, there will be no enclosed or isolated wetlands within the immediate project area, and it will compensate for 7.47 AAHUs.

The USACE will fully compensate for 147.96 AAHUs based on the impacts on wetlands and non-jurisdictional BLH from the construction of the IER #16 actions. Although the avoidance of the enclosure of wetlands by levees was considered during design, the USACE policy is that, to the extent justified, the adverse direct environmental impacts of projects will be mitigated. Indirect impacts such as land development are subject to compliance with local and state permit and zoning requirements, and therefore, local and state interests would determine land use restrictions and whether to require the mitigation for any land development activities (appendix I in IER #16). Non-development easements for wetlands enclosed by the project described in IER #16 were not purchased as part of the project. If Department of the Army permits are sought for future development projects, impacts would be appropriately compensated through the permit process.

To minimize the impacts on 2,485 acres of wetlands located north of US 90, the combined cross-section at the perimeter of the project was sized to equal the combined cross-section of the openings through US 90 prior to HSDRRS construction. The approximately 265 acres of

wetlands located south of US 90 will continue to have hydrologic connections, but with a reduced cross-sectional area (IER #16).

As noted in IER #16, the USFWS recommends that the previous induced development study examine potential development over the period of analysis (i.e., 50 years) to be consistent with the planning process. Information about potential development of the area in question derived from this analysis was used to determine wetlands and non-jurisdictional BLH mitigation requirements. The St. Charles Parish Development Study demonstrates the likely development that will occur within the study area, and the period of analysis for the induced development is appropriate. However, the USACE does not mitigate for indirect impacts such as induced development, where local and state entities regulate zoning and land use and are able to assign mitigation requirements directly to the developer. The USFWS recommendation was not adopted as a mitigation measure (appendix I in IER #16).

Due to some of the proposed features detailed in IER #16, the USFWS determined that the drainage capacity of the area between US 90 and the proposed levee could be reduced. The USFWS is concerned about the potential for ponding in the area and subsequent impacts on wetlands vegetation and to US 90. The USFWS recommended that the CEMVN undertake additional hydrologic studies to determine the effects of those drainage capacity reductions. It was determined that the 289-acre area below US 90 (164 acres of wetlands) will experience reduced water exchange. During rainfall, wave, or wind-driven events, water will at times pond within this 289-acre area. However, with the reduced combined cross-sectional area into the 289-acre area, the amount of water entering this area from the south will also be reduced. Additionally, as stated in IER #16, the discharge lines from the US 90 Pump Station were extended so that the pump station discharge was on the flood side of the new levee alignment, thereby eliminating that input of water into the 289-acre area. The Hydrology and Hydraulics analysis also included an evaluation of water surface elevations that will occur with the project in place versus without project construction, specifically when the drainage structures will be closed. The water surface evaluation analyses indicated that increases in water surface elevations within the project area, including the 289-acre area south of US 90, will be less than 0.5 ft in smaller storm events and yield an approximately 1-foot increase in extreme storm events. Potential impacts on US 90 will likely occur only during very extreme storm events. Since the drainage control structures will not be closed except during storm events, changes in water surface elevation due to structure closure will be infrequent and of a short duration. Based on this information and the significant amount of research already done to investigate impacts on coastal marshes caused by hydrologic management for marsh management activities, it was determined that the USFWS recommendation for additional hydrologic studies of this area is unnecessary and is not a mitigation measure.

The USACE will fully compensate for approximately 19.78 AAHUs based on the impacts on wetlands and non-jurisdictional BLH from the construction of the IER #17 actions.

5.3.1.6 Wetlands Design and Construction Mitigation for HSDRRS Borrow Impacts

For most of the borrow sites, the USFWS recommended that a buffer zone of at least 100 ft be designated between the borrow site and any jurisdictional wetlands in which no excavation would be allowed. In addition, the USFWS, NMFS, LDWF, and LDNR will be consulted regarding the adequacy of any proposed alternative mitigation sites. Some mitigation credits for non-jurisdictional BLH have been purchased for borrow sites used for HSDRRS construction. The following tables indicate the amount of compensatory mitigation that would be required if the borrow areas are completely excavated; the amount of mitigation credits purchased will depend on actual impacts on the portions of the borrow sites that were in fact excavated.

5.3.1.6.1 IER #18, Government-Furnished Borrow

Currently, the CEMVN and the local non-Federal sponsor will fully compensate for any unavoidable projected-related loss of non-jurisdictional BLH habitat (197.84 AAHUs) caused by IER #18 project borrow sites as shown in table 5-1.

Table 5-1. Non-jurisdictional BLH AAHUs Required for IER #18 Compensatory Mitigation

IER #18 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
1418/1420 Bayou Road	St. Bernard	6.20
1572 Bayou Road	St. Bernard	1.79
Dockville	St. Bernard	61.24
Belle Chasse	Plaquemines	3.68
Maynard	Orleans	14.65
Cummings North	Orleans	54.14
Churchill Farms Pit A	Jefferson	10.62
Westbank Site G	Jefferson	45.52
Total		197.84

The only borrow sites that have been utilized by the HSDRRS construction contractors are the Maynard, Churchill Farms Pit A, and the Bonnet Carré Spillway North borrow areas.

5.3.1.6.2 IER #19, Contractor-Furnished Borrow

Approximately 5.4 acres of non-jurisdictional BLH would be mitigated for impacts at the proposed Kimble # 2 borrow site. The mitigation assessment for the non-jurisdictional BLH impacts has not been conducted (required mitigation AAHUs have not been calculated). Assessment of mitigation would be conducted prior to impacts and subsequent to that assessment mitigation would be implemented. The jurisdictional wetlands impacted at the River Birch Phase I and Phase 2 borrow sites would be mitigated by the landowner prior to the acquisition of any material for use on the HSDRRS by a contractor. Impacts on wetlands are related to prior-permitted landfill construction and not borrow excavation, which is a secondary use at the site. The CEMVN will require verification that wetland and non-jurisdictional BLH impacts, present and future, have been mitigated. Additionally, per IER #19, the CEMVN would provide the USFWS with maps, descriptions of habitats, and impacts for all future contractor-furnished borrow sites. Only the River Birch Phase 2, Pearlington Dirt Phase I, and the Eastover Phase I borrow areas have been used for construction activities.

5.3.1.6.3 IER #22, Government-Furnished Borrow

Approximately 118.54 AAUHs of non-jurisdictional BLH would be required for compensatory mitigation at the IER #22 borrow sites as shown in table 5-2. Only the Westbank F borrow area has been used for HSDRRS construction.

Table 5-2. Non-jurisdictional BLH AAHUs Required for IER #22 Compensatory Mitigation

IER #22 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Tabony	Plaquemines	28.90
Westbank F	Jefferson	85.00
Westbank I	Jefferson	4.64
Total		118.54

5.3.1.6.4 IER #25, Government-Furnished Borrow

Approximately 284 AAUHs of non-jurisdictional BLH would be required for compensatory mitigation at the IER #25 borrow sites as shown in table 5-3. None of these borrow sites have been utilized for HSDRRS construction.

Table 5-3. Non-jurisdictional BLH AAHUs Required for IER #25 Compensatory Mitigation

IER #25 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Stumpf Phase 1	Orleans	88.00
Stumpf Phase 2	Orleans	143.00
Tac Carrere	Plaquemines	12.10
Westbank E Phase 1	Jefferson	13.10
Westbank E Phase 2	Jefferson	27.80
Total		284.00

5.3.1.6.5 IER #28, Government-Furnished Borrow

Approximately 8.45 AAUHs of non-jurisdictional BLH would be required for compensatory mitigation at the IER #28 borrow sites as shown in table 5-4. None of the borrow sites have been used for HSDRRS construction.

Table 5-4. Non-jurisdictional BLH AAHUs Required for IER #28 Compensatory Mitigation

IER #28 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Bazile	Plaquemines	3.93
Johnson/Crovetto	St. Bernard	4.35
Westbank F Access Route	Jefferson	0.17
Total		8.45

5.3.1.6.6 IER #29, Contractor-Furnished Borrow

Approximately 48.6 AAUHs of non-jurisdictional BLH are required for compensatory mitigation at the IER #29 borrow sites and distributed as shown in table 5-5. All three of these borrow sites have been used for HSDRRS construction. The private contractor shall provide mitigation to

compensate for the unavoidable, project-related loss of forested lands. Such mitigation can be obtained from any approved mitigation bank. The verification of purchased mitigation credits will be provided to the CEMVN by the mitigation bank.

Table 5-5. Non-jurisdictional BLH AAHUs Required for IER #29 Compensatory Mitigation

IER #29 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Eastover Phase II	Orleans	6.50
Tammany Holding	St. Tammany	18.00
Willow Bend Phase II	St. John the Baptist	24.10
Total		48.60

Additionally, because of the potential for hydrologic modifications caused by borrow material excavation at the Willow Bend site to impact nearby, jurisdictional wetlands outside of the project area, the USFWS recommends that the CEMVN conduct an investigation to determine the extent of these potential impacts.

5.3.1.6.7 IER #30, Contractor-Furnished Borrow

The IER #30 borrow action impacted non-jurisdictional BLH, and the compensatory mitigation of approximately 189.4 AAHUs will be completed by the landowner of the Contreras Dirt (Cells E, F & Z) site prior to excavation (table 5-6).

Table 5-6. Non-jurisdictional BLH AAHUs Required for IER #30 Compensatory Mitigation

IER #30 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Contreras Dirt (Cells E, F & Z)	St. Bernard	189.4
Total		189.4

Additionally, because of the potential for hydrologic modifications caused by borrow material excavation at the Contreras and Henley sites to impact nearby, jurisdictional wetlands outside of the project areas, the USFWS recommends that the CEMVN conduct an investigation to determine the extent of these potential impacts. Only the Contreras borrow site has been used for HSDRRS construction.

5.3.1.6.8 IER #31, Contractor-Furnished Borrow

The IER #31 borrow actions could directly impact non-jurisdictional BLH at the Acosta 2, Idlewild Stage 2, Lilly Bayou, Port Bienville, Raceland Raw Sugars, Scarsdale, and Spoil Area borrow sites. Compensatory mitigation of 572.17 AAHUs of non-jurisdictional BLH is the responsibility of the respective landowners or contractors, and will be obtained or completed before excavation, with the CEMVN requiring verification of appropriate mitigation prior to excavation of borrow material. Table 5-7 illustrates the distribution of the borrow sites with compensatory mitigation needs.

Table 5-7. Non-jurisdictional BLH AAHUs Required for IER #31 Compensatory Mitigation

IER #31 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Acosta 2	St. Bernard	0.45
Idlewild Stage 2	Plaquemines	56.49
Lilly Bayou	East Baton Rouge	242.72
Port Bienville	Hancock County	55.72
Raceland Raw Sugars	Lafourche	0.56
Scarsdale	Plaquemines	41.04
Spoil Area	St. Bernard	175.19
Total		572.17

Also, as noted in IER #31, because of the potential for hydrologic modifications caused by borrow material excavation at the Acosta 2, Lilly Bayou, King Mine, Port Bienville, Scarsdale, and Spoil Area sites to impact nearby, jurisdictional wetlands outside of the project areas, the USFWS recommends that the CEMVN conduct an investigation to determine the extent of these potential impacts. An investigation into the potential for hydrologic modifications caused by borrow material excavation will be considered. The Acosta 2, Idlewild Stage 2, Lilly Bayou, Port Bienville, and the River Birch Landfill Expansion borrow sites have been used for HSDRRS construction.

5.3.1.6.9 IER #32, Contractor-Furnished Borrow

The HSDRRS borrow action would impact approximately 96.2 AAHUs of non-jurisdictional BLH at the Nairn and 3C Riverside Phase 3 borrow sites. Only the Idlewild Stage 1, Plaquemines Dirt and Clay, and the 3C Riverside Phase 3 borrow sites have been used for HSDRRS construction. Compensatory mitigation would be obtained or completed by the landowners of the Nairn and 3C Riverside Phase 3 sites before excavation, with the CEMVN requiring verification of appropriate mitigation prior to excavation of borrow material. Table 5-8 illustrates the distribution of the borrow sites with compensatory mitigation needs for IER #32 borrow actions.

Due to placement of temporary mats, a 0.04-acre area of wetlands on the 3C Riverside Phase 3 site was impacted by the landowner to allow for crossing to non-wetland areas. The affected wetlands would be restored to their pre-construction state after borrow excavation is complete. This action was permitted through the CEMVN's CWA Section 404 regulatory program (permanent number MVN 2009-0698-EBB).

Table 5-8. Non-jurisdictional BLH AAHUs Required for IER #32 Compensatory Mitigation

IER #32 Borrow Areas	Parish	AAHUs of Non-jurisdictional BLH Needed
Nairn	Plaquemines	11.60
3C Riverside Phase 3	St. Charles	84.60
Total		96.20

Also, as noted in IER #32, because of the potential for hydrologic modifications caused by borrow material excavation at the Citrus Lands, Conoco Phillips, Idlewild Stage 1, Nairn, Plaquemines Dirt and Clay, and 3C Riverside sites to impact nearby, jurisdictional wetlands outside of the project areas, the USFWS recommended that the CEMVN conduct an investigation to determine the extent of these potential impacts. An investigation into the potential for hydrologic modifications caused by borrow material excavation will be considered.

5.3.1.7 Fisheries Design and Construction Mitigation for HSDRRS Impacts

5.3.1.7.1 New Orleans East Sub-basin (IER #11 Tier 2 Borgne and IERS #11 Tier 2 Borgne)

Construction of project components described by IER #11 Tier 2 Borgne within the New Orleans East sub-basin required that all design recommendations for the gates made by NMFS in a letter dated September 17, 2008, will be considered during final design to ensure that fisheries access is maintained to the maximum extent practicable.

5.3.1.7.2 Belle Chasse Sub-basin (IER #13) and the Gretna-Algiers Sub-basin (IER #12)

Flood risk reduction structures within waterways should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered, and coordination should continue with the natural resource agencies to ensure that fish passage features are incorporated to the fullest extent practicable.

5.3.1.8 Wildlife Design and Construction Mitigation for the HSDRRS and Borrow Impacts

A general wildlife mitigation measure included in many of the IERs is to limit the removal of trees in forested wetlands to the fall or winter, if practicable, to minimize impacts on nesting migratory birds within the project area. Alternatively, if trees will be removed during bird nesting season, pre-construction surveys for nesting birds will be conducted, and all eggs and nestlings within the project area will be relocated before the start of construction.

5.3.1.8.1 General Wildlife Mitigation Measures

Although not specifically detailed in the IERs or their Decision Records, the tree mitigation measures that would be utilized at the HSDRRS is found in the construction contractors P&S, and include the following tree protection language:

- Trees shall be protected from wounds to the bark, limbs, and foliage.
- The critical root zone shall be protected from compaction and grading.
- Changes in temporary site drainage and ponding shall be minimized to the extent practicable.

Also, the critical root zone of trees designated to be protected shall be surrounded by a chain-link fence 4 ft in height, supplied and erected by the CEMVN construction contractor. The critical root zone shall be defined by an area extending 1.5 ft radius from each tree for each inch of "Diameter at Breast Height," or at the drip line of the tree, whichever is further out from the trunk. The fence shall be securely erected and installed prior to any movement through the project site by construction vehicles or equipment, and remain in place until construction and cleanup activities are completed. The critical root zone shall remain free of all construction activities, including trenching, staging, stockpiling, and storage of materials. Vehicles and equipment shall not drive or park within the critical root zone. Variation of the critical root zone size or configuration will only be permitted where it is absolutely necessary for construction of the project, and requires written approval by the CEMVN contracting officer. Short duration

alterations of the critical root zone involving wood chips and limited equipment travel shall be submitted in writing for approval. The construction contractor shall not operate equipment in vegetated areas outside the work limits.

5.3.1.8.2 Specific Wildlife Mitigation Measures

As detailed in the IER #11 Tier 2 Borgne, the number and siting of openings in the HSDRRS levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats. Additionally, the HSDRRS structures within a waterway should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure and invert to enhance organism passage. In addition, as detailed in IER #11 Tier 2 Borgne, various wildlife ramp designs should be considered.

In order to minimize the impact of T-walls on wildlife movement, it was recommended that earthen ramps should be constructed within the HSDRRS features, specifically the LPV-145 reach, and two earthen ramps each should be constructed in LPV reaches 146 and 148 (IER #10). It was recommended that the crossings be spaced, if feasible, at an approximate equal distance from other ramps or potential crossing sites. Instead of constructing six ramps, nine wildlife openings (roller gates) were constructed, which facilitates terrestrial wildlife movement across the T-wall. Three openings are located in each of the following T-wall reaches: LPV-145, LPV-146, and LPV-148 (see figure 4-7). Since the gates were constructed for the dual purpose of inspection and wildlife movement, and inspection activities would be conducted via a motorized vehicle, ramps were constructed at the gate openings to provide a safe grade for vehicle travel on the floodwall embankment. The ramps also provide a gradual transition for wildlife using the gates as an access point through the floodwall. Gates remain open at all times except in the event of a storm.

Animal passage features (i.e., culverts in varying sizes) at the LA 3134 ramp due to the increased elevation were incorporated as recommended in order to minimize the impacts of habitat and population fragmentation (IER # 14). The locations and designs of the passage features were coordinated with the USFWS and the JLNHPP.

5.3.1.8.3 Specific Bird Mitigation Measures

The CEMVN implemented the bird protection measures through four main methods: 1) where known colonies exist, develop, and implement a nesting prevention plan; 2) through periodic inspections of construction areas by biologists; 3) by universally incorporating language into construction specifications that required reporting of sightings of colonial nesting bird colonies and bald eagles by the contractors' employees; and 4) a system-wide overflight of the HSDRRS alignment in April 2010 to identify bird nesting locations.

Within the St. Charles sub-basin, a historic colonial nesting wading bird rookery was identified near the LaBranche wetlands levee and mitigation measures were stipulated during construction activities (IER #1 and IER Supplemental #1). A Nesting Prevention Plan was created and implemented to deter nesting and the inadvertent "take" of nests or of birds within a 1,000 ft buffer zone. This 1,000 ft buffer encompassed the known historic rookery. These nesting prevention measures were conducted 7 days per week from dawn to dusk throughout the nesting season (February 15 to September 1). The measures implemented included auditory deterrents and visual repellents. At the rookery site more intense measures were taken, including the constant presence of a bird abatement team member. However, despite these actions, nesting (yellow-crowned night heron [*Nyctanassa violacea*]) still occurred at the project area. The CEMVN then began a process to document, report, and monitor nests for the yellow-crowned night heron. Personnel from the USFWS and the USACE made periodic site visits to observe the reported nests. All active nests were monitored until the end of nesting season. Some of the

nests were unsuccessful, apparently due to predation, and the USFWS concluded that a “take” was not justified for any of the lost nests due to the construction activities for the HSDRRS project.

In addition, two bald eagle nests were also observed approximately 660 ft from the LaBranche wetland levee construction activities near the Louis Armstrong New Orleans International Airport (IER #1). Construction contractors should be informed of the possible presence of nesting bald eagles in the vicinity of the project area, and should identify, avoid, and immediately report any such nests within 1,000 ft of the levee centerline to the CEMVN.

As detailed in IER #2, avoidance of adverse impacts on wading bird colonies would occur through careful design of project features and timing of construction. To minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, mitigation measures similar to those described for the St. Charles Sub-basin would be implemented.

On-site construction contractors should be informed of the possible presence of nesting bald eagles in the vicinity of the IER #2 project area, and should identify, avoid, and immediately report any such nests within 1,000 ft of the levee centerline to the USACE staff.

On January 27, 2011, a colonial nesting site was identified, across from the Parish Line Canal between Veterans Boulevard and the Louis Armstrong International Airport. As part of the mitigation measure, a USACE employee visited the site on January 28, 2011, to determine if the colonial nesting birds were utilizing the area for nesting purposes. It was determined that although the birds were possibly using the site as a resting area, the site had not been previously used for nesting purposes. The construction contractor was asked to provide a Nesting Prevention Plan and included measures to deter birds from nesting within 1,000 ft of the construction activities. However, the prevention plan included actions and deterrents that were unacceptable under the Migratory Bird Treaty Act and the contractor was asked to submit a new plan. Under guidance from the USACE and the USFWS, the construction contractor resubmitted the prevention plan and included auditory deterrents such as clapping, yelling, and an hourly discharge from propane cannons, along with visual repellants such as streamers. In addition, the contractor performed a visual inspection of the site three times per day, 7 days per week from dusk to dawn, for the duration of the construction activities. The contractor provided weekly reports of these inspections.

Tree clearing mitigation measures for nesting migratory birds were recommended as previously described (IERs #7, #11 Tier 2 Borgne, #9, #10, #15, and #17).

To avoid impacts on bald eagle nesting locations, mitigation measures similar to those described for the St. Charles Sub-basin would be implemented (IERs #7, #11 Tier 2 Borgne, #9, #10, #12, and #13).

The USACE would minimize disturbance to colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, and mitigation measures similar to those described for the St. Charles Sub-basin would be implemented.

A colonial wading bird rookery (great egrets and great blue herons) was discovered in April 2010 near construction pile-driving activities for “V-levee” IER #14 reach near the JLNHPP. Nests closest to the pile driving were approximately 375 ft away. Due to the proximity of the wading bird rookery to the pile-driving activity, the USACE and the USFWS personnel conducted a site visit to determine the distance from the active construction to the rookery, the nest production status, and the impact of pile driving on the nesting birds. Nests were observed

during pile driving and no noticeable change in behavior and no obvious flushing of adults or young were observed. At the time of the site visit, pile-driving activity had been progressing westward towards the rookery from LA Hwy 3134 towards LA Hwy 45 and had just past the closest proximity to the rookery earlier that day. The nests closest to the pile driving were measured 125 yards south of the levee ROW. The rookery is located in a mature, closed-canopy, tupelo-bald cypress swamp in 2 to 3 ft of standing water and was comprised mostly of great egrets, but a few great blue herons were also observed. Immature great egrets were sighted in numerous nests and were being actively fed by adults, which would leave the nests periodically to capture prey. Based on these observations, the USFWS concluded that the levee work and the pile driving at the “V-levee” floodwall would not result in a “take” under MBTA.

5.3.1.9 Wildlife Design and Construction Mitigation for the HSDRRS Borrow Impacts

5.3.1.9.1 Specific Bird Mitigation Measures

IER #18

Tree clearing mitigation measures will be implemented as previously described (IERs #18 and #19).

IER #25 documented a bald eagle nest in the vicinity of the Westbank D and Westbank E sites. To avoid adverse impacts on bald eagle nesting locations, mitigation measures similar to those described for the St. Charles Sub-basin will be implemented (IERs #18 and #25). However, these borrow sites have not been used, and will likely not be used in the future due to Jefferson Parish ordinances restricting the distances that borrow sites can be located from structures and subdivision boundaries.

IERs #28, #29, #30, #31, and #32

Colonial nesting wading birds (including herons, egrets, and ibis), seabirds/waterbirds (including terns, gulls, black skimmers, and brown pelicans) and bald eagles have the potential to nest in the IERs #28, #29, #30, #31, and #32 project areas. Mitigation measures for nesting birds similar to those described for the St. Charles Sub-basin would be implemented.

5.3.1.10 Fisheries and EFH Design and Construction Mitigation for the HSDRRS Impacts

5.3.1.10.1 Specific Fisheries and EFH Mitigation Measures

Within the New Orleans East sub-basin, the construction of IER #11 Tier 2 Borgne components required that all design recommendations for the gates made by NMFS in a letter dated September 17, 2008, be considered during final design to ensure that fisheries access is maintained to the maximum extent practicable. In addition, four 48-inch culverts within the Bayou Bienvenue cofferdam were installed during construction of the gate structure to allow for hydrologic exchange and potential fish passage.

5.3.1.11 Threatened and Endangered Design and Construction Mitigation for the HSDRRS Impacts

5.3.1.11.1 Specific Threatened and Endangered Species Mitigation Measures

Within the Jefferson East Bank sub-basin (IERs #2, #3, IER Supplemental #2, and IER Supplemental #3), standard manatee protection measures would be implemented to minimize the potential for the HSDRRS component construction to cause adverse impacts on manatees during the construction period (approximately 2 to 2.5 years). These procedures were recommended by the USFWS and have been adopted by the CEMVN for use in situations where in-water construction activities potentially occurred when manatees may be present. The procedures included the following:

- All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees, and would be reminded that the observation of water-related activities for the presence of manatees was the contract personnel's responsibility.
- Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant of manatees during active construction/dredging operations or within vessel movement zones (i.e., the work area). At least one sign would be placed where visible to the vessel operator.
- Siltation barriers, if used, would be made of material in which manatees could not become entangled and would be properly secured and monitored.
- If a manatee is sighted within 100 yards of the active work zone, the following special operating conditions would be implemented: moving equipment will not be operated within 50 ft of a manatee; all vessels will operate in no-wake/idle speeds zones within 100 yards of the work area; and siltation barriers, if used, would be resecured and monitored.
- Once the manatee leaves the 100-yard buffer zone around the work area of its own accord, special operating conditions would be no longer necessary, but careful observation would be resumed.
- Any manatee sighting would be immediately reported to the USFWS, the LDWF, and the LNHP.

No manatees were sighted during construction activities. Silt curtains were used to contain material in the stockpile site if deemed effective and maintainable at the time of construction.

Also mitigation measures specifically detailed in IER #3 and IER Supplemental #3.a would be used to minimize the potential for construction to cause adverse impacts on Gulf sturgeon and their critical habitat. The CEMVN would adhere to a dredging/construction window for the project on the eastern side of the Lake Pontchartrain Causeway so that construction activities in the project area would occur during the months of May through September. Also, the bucket drop procedure developed by the USFWS would be employed to encourage any Gulf sturgeon in the vicinity to leave the area.

Within the Orleans East Bank Sub-basin (IER #5), the CEMVN would avoid adverse impacts on manatee and Gulf sturgeon within the HSDRRS project area. Manatee protective measures are the same as those listed in the Jefferson East Bank sub-basin.

In the New Orleans East Sub-basin, the IER #11 Tier 2 Pontchartrain HSDRRS project component construction required these mitigation measures as outlined below:

- Manatee, Gulf sturgeon, and sea turtle protection measures will be implemented during construction and operation of this project as outlined in IER #11 Tier 2 Pontchartrain (section 3.2.7 of IER #11).
- As a precautionary measure, before the cofferdam is dewatered for construction activities to commence, the area will be surveyed for the presence of Gulf sturgeon using a hummingbird side scanner, gill nets, and an electroshocker. This survey was completed during cofferdam dewatering.

- The construction contractor will advise the government when the cofferdam is scheduled for dewatering and the government will coordinate with the interagency team to have biologists on hand, if necessary, to relocate Gulf sturgeon to appropriate habitat. If any sturgeons are observed, the USACE will reinitiate consultation with NMFS on the appropriate means for relocating Gulf sturgeon to a safe location away from the project area.

Various future mitigation measures were also agreed to, which are outlined in section 5.3.2.2.2.

The construction of Tier 2 Borgne project components required that all design recommendations for the gates made by NMFS in a letter dated September 17, 2008 will be considered during final design to ensure that fisheries access is maintained to the maximum extent practicable. The USACE would also avoid impacts on manatees and sea turtles. Manatee protective measures are similar to those listed in the Jefferson East Bank sub-basin.

In order to minimize the potential for the HSDRRS construction activities to cause impacts on sea turtles, construction conditions recommended by NMFS in their August 12, 2008 letter would be followed. These conditions include the following:

- All personnel associated with the project will be told of or instructed about the potential presence of sea turtles and the need to avoid collisions with sea turtles.
- All construction personnel will be responsible for observing water-related activities for the presence of these species. All construction personnel would be advised that there are civil and criminal penalties for harming, harassing, or killing sea turtles, which are protected under the ESA.
- Siltation barriers will be made of materials in which sea turtles cannot become entangled, will be properly secured, and will be regularly monitored to avoid protected species entrapment.
- Barriers will not block sea turtle entry to or exit from designated critical habitat without prior agreement from the NMFS.
- All vessels associated with the construction project will operate at “no wake/idle” speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a 4 ft clearance from the bottom.
- All vessels will follow deep-water routes (e.g., marked channels) whenever possible. If a sea turtle is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions will be implemented to ensure its protection. These precautions would include the cessation of operation of any moving equipment closer than 50 ft of a sea turtle. Operation of any mechanical construction equipment will cease immediately if a sea turtle is seen within a 50 ft radius of the equipment. Activities will not resume until the protected species has departed the project area of its own volition.
- Any collision with and/or injury to a sea turtle will be reported immediately to the NMFS and the local authorized sea turtle stranding/rescue organization.

No observations or collisions with sea turtles occurred during construction. In the Chalmette Loop Sub-basin (IER #8), the CEMVN should reinstate Section 7 consultation with the USFWS if the protective measures for the West Indian manatee are not incorporated into the CEMVN contractor P&S for work within any adjacent waterbody.

5.3.1.12 Cultural Resources Design and Construction Mitigation for the HSDRRS and Borrow Impacts

Avoidance mitigation measures were utilized for the HSDRRS construction and borrow efforts and are listed in table 4-22 in section 4.2.9.2.1. More detailed mitigation measures for cultural resources are detailed as follows.

5.3.1.12.1 General Cultural Resources Mitigation Measures

Through consultation with the SHPO and THPO and per Section 106 of the NHPA, the CEMVN will seek to minimize any impacts on cultural resources from the HSDRRS. Based on the determination made by the SHPO, specific conditions will be followed by the CEMVN. If any unrecorded cultural resources were determined to exist within the proposed project boundaries, then no work will proceed in the area containing these cultural resources until a CEMVN archaeologist was notified and final coordination with the SHPO and THPO was completed (per the CEMVN-PM-RN/SHPO Standard Operating Procedure). This mitigation measure was implemented by incorporating contract language into construction specifications that required the contractors' employees to report the detection of any cultural resources discovered during the course of construction activities, if discovered, stopping work in the immediate area of the cultural resource, and notifying CEMVN staff of the discovery so appropriate action could be taken.

5.3.1.12.2 Specific Cultural Resources Mitigation Measures for Borrow Impacts

CEMVN committed to developing an Archaeological Resources Protection Plan should the Bonnet Carré North site be utilized (IER #18). However, the low probability of cultural resources being found led to the determination that an abbreviated monitoring plan should be implemented at the Bonnet Carré North borrow site. The following steps were detailed within the monitoring plan:

- The CEMVN held a briefing at the pre-construction meeting with the HSDRRS construction inspectors concerning the potential for cultural finds to be found at the site.
- Random visits were made to the field location to verify if potential cultural resources are in danger. As of October 15, 2010, no cultural resources were found at the Bonnet Carré North borrow site.

In IER #18, the Churchill Farms Pit A borrow site was identified as having the potential for cultural resources being impacted, and the CEMVN committed to developing an Archaeological Resources Protection Plan. The plan developed in February of 2010 details the monitoring of borrow excavations from the Churchill Farms Pit A site. The following steps are within the monitoring plan:

- The CEMVN developed a Daily Report form that is completed by a qualified archaeologist while excavation activity occurs at the site. It is used as an internal tracking mechanism and verification that borrow excavations are monitored.
- The Daily Report forms are submitted to the CEMVN on a monthly basis, with instruction to contact the CEMVN within that 24-hour period, should a discovery be made.

- Should any cultural resource be unexpectedly discovered, excavations in that area will cease until an acceptable recovery or preservation plan is developed with SHPO and Indian Tribes.
- If no cultural resources are discovered during monitoring, the results of the monitoring will be integrated into a final report submitted via letter to SHPO and Indian Tribes, and the final coordination will be integrated with the final environmental documents.

No cultural resources were found at the Churchill Farms Pit A borrow site.

5.3.1.13 Recreational Resources Design and Construction Mitigation for the HSDRRS Risk Impacts

5.3.1.13.1 Specific Recreational Resources Mitigation Measures

As noted in IER #3 for the flotation channel stockpiling work in the Jefferson East Bank Sub-basin, lighted marine buoys would be placed in Lake Pontchartrain to delineate the hazard of the stockpiled dredged sediment for the project work.

As detailed in IERs #7 and #11 Tier 2 Borgne, impacts on Bayou Sauvage NWR will be avoided when feasible. The CEMVN should continue to coordinate with NWR personnel during the planning and compatibility determination process (compatibility determinations are documents written, signed and dated by the NWR manager and the regional chief of refuges that signify whether proposed or existing uses of the NWR are compatible with their establishing purposes and the mission of the NWR System). A Special-Use Permit should be obtained prior to any entrance onto the refuge, and coordination should continue until construction is complete and prior to any subsequent maintenance. A compatibility determination will be needed prior to work being conducted in the area.

Areas on the Bayou Sauvage NWR where soil borings have been taken should be assessed to ensure accuracy of the anticipated impact area (0.18 acre) and determine recovery impacts (IER #7). Guidelines on the deposition of dredge material within the Bayou Sauvage NWR are provided for construction activities in IER #11 Tier 2 Borgne. The CEMVN would ensure that impacts and encroachments onto public lands are avoided. Unavoidable impacts and encroachments, when permissible by the appropriate managing agency, should be minimized and appropriately mitigated.

Continued coordination should be conducted with the LDWF, Scenic Rivers Program regarding any additional permits or conditions that may be required to perform work in Bayou Bienvenue. Also, to further minimize recreational boater access and associated marsh impacts, signs indicating restricted access should be posted around the maintenance channel, channel plugs, and adjacent marsh.

For the Belle Chasse Sub-basin (IER #13), if mitigation lands are purchased for inclusion within state-managed or Federally managed lands, those lands must meet certain requirements. To satisfy these requirements, the land manager of that management area should be contacted early in the planning phase regarding such requirements. Additionally, if applicable, a General Plan should be developed by the CEMVN, the USFWS, and the managing natural resource agency in accordance with Section 3(b) of the Fish and Wildlife Coordination Act for mitigation lands.

5.3.1.14 Air Quality Design and Construction Mitigation for the HSDRRS and Borrow Impacts

5.3.1.14.1 General Mitigation Measures

The construction equipment and haul trucks will have catalytic converters and mufflers to reduce exhaust emissions. Routine maintenance of all vehicles and other construction equipment will be implemented to ensure that emissions are within the appropriate design standards. Dust suppression methods will be implemented to minimize dust emissions at construction sites and at borrow sites.

5.3.1.15 Noise Design and Construction Mitigation for the HSDRRS Impacts

5.3.1.15.1 General Noise Mitigation Measures

Construction equipment should be routinely checked to ensure that the equipment is operating properly.

5.3.1.15.2 Specific Noise Mitigation Measures

Much of the HSDRRS construction was performed 24 hours a day 7 days a week in order to meet the aggressive schedule for providing risk reduction to the Greater New Orleans Metropolitan Area. In order to limit noise emissions to sensitive receptors from the HSDRRS pile-driving construction activities for certain reaches of the HSDRRS, certain restrictions were developed as indicated in table 5-9.

Table 5-9. Noise Restrictions from Pile Driving Work from the HSDRRS Project Components[†]

IER* # & HSDRRS Sub-basin	Reach	Exceptions to Permissible Hours
<i>St. Charles</i>		
1/S 1	LPV-03d.2	Daylight hours only
<i>Jefferson East Bank</i>		
2/S 2	All reaches	Pile driving limited to 7 am to 10 pm
3/S 3	LPV-17.2, LPV-10.2, LPV-11.2, LPV-12.2, LPV-17.2	No pile driving between 9 pm and 6 am
<i>Orleans East Bank</i>		
4	All reaches	No pile driving between 9 pm and 6 am
5	All reaches	Pile driving limited to 7 am to 10 pm: LPV-101.02; 7 am to 9 pm Monday-Friday, 8 am to 9 pm Saturday, no work Sunday
<i>New Orleans East</i>		
6/S 6	LPV-107	No pile driving between 9 pm and 6 am
7/ S 7	LPV-109.02b	No pile driving between 9 pm and 6 am
<i>Chalmette Loop</i>		
10	all reaches	No pile driving between 9 pm and 6 am
<i>Belle Chasse</i>		
13	WBV-09a, WBV-09b	No pile driving between 9 pm and 6 am
<i>Gretna-Algiers</i>		
12/S 12	WBV-09b	No pile driving between 9 pm and 6 am

Table 5-9, continued

IER* # & HSDRRS Sub-basin	Reach	Exceptions to Permissible Hours
<i>Harvey-Westwego</i>		
14/S 14.a	WBV-14.b	No pile driving between 9 pm and 6 am
<i>Lake Cataouatche</i>		
16/S 16.a	WBV-73, WBV-75, WBV-77	No pile driving between 9 pm and 6 am

*S - Supplemental

¹Information based on restrictions in CEMVN construction contracts

5.3.1.16 Transportation HSDRRS Design and Construction Mitigation for Risk Reduction and Borrow Impacts

5.3.1.16.1 General Transportation Mitigation Measures

Traffic coordination meetings were held frequently between the CEMVN, LADOTD, RPC, and State Police. The meetings discussed traffic situations, conditions, and traffic management strategies.

5.3.1.16.2 Specific Risk Reduction Transportation Mitigation Measures

Construction of IER #11 Tier 2 Borgne project components required that the USCG and the navigation industry continue to play an active role in the navigation computer simulations of ships passing through the GIWW gate, and the CEMVN maintained its commitment to provide safe navigation on the GIWW through the structure. The CEMVN committed to work collaboratively with the USCG during the computer simulations to ensure that risk is taken into consideration during the design process. However, because of the expedited schedule for the IER #11 Tier 2 Borgne project, multiple barges will be needed in the channel for cranes driving piles, material storage and staging, and the moving of materials to various work locations. There will be multiple pile-driving crews working on the face of the wall at all times. In addition, multiple supply barges may need to be towed to the working barges in order to continue operations without stopping work. There will also be similar operations going on in the canal at two to three locations, requiring the passage of large crane barges and other equipment side-by-side. This means that it would not be feasible to limit the channel strictly to one-way traffic as recommended by LDNR to minimize the project footprint.

5.3.1.16.3 Specific Borrow Transportation Mitigation Measures

Flagmen, signage, cones, barricades, and detours were used, where required, to facilitate the movement of heavy equipment and local traffic on affected road segments (IERs #10, #19, #22, #23, #25, and #26). Appropriate measures to ensure safety and facilitate the movement of traffic would be implemented at all approved borrow areas.

5.3.1.17 Socioeconomic Resources and Environmental Justice Design and Construction Mitigation for the HSDRRS Borrow Impacts

5.3.1.17.1 General Socioeconomic Resources and Environmental Justice Mitigation Measures

Risk Reduction Projects

Although there is no requirement through regulations to minimize socioeconomic impacts from the construction of the HSDRRS, adverse impacts on socioeconomic resources were minimized primarily by designing the footprint of a large portion of the risk reduction work within the existing alignment ROWs, thereby reducing the need to acquire additional property or to “take” property.

Additionally, the plans and specifications submitted by construction contractors for any design build proposals or early contractor involvement, such as work described in IERs #5 and #11 (Tier 2 Pontchartrain and Borgne), generally had provisions to limit or avoid any indirect consequences for the socioeconomic resources within the HSDRRS project areas. The following are specifications that were included in the request for proposals for the permanent pumps and Borgne barrier projects:

- Minimize impact on the overall footprint.
- Avoid or minimize disturbance of contaminated sediments and other hazardous, toxic, or radioactive waste in the study area if they are found to be present.
- Minimize impact on recreation and greenspace.
- During construction of the pump stations, demolition of the existing ICS and operation of the stations will conform to the noise and vibration limitations of the New Orleans Municipal Code for Sound Attenuation. Mitigation measures could be required to reduce noise impacts to acceptable levels and comply with the local noise ordinance if necessary.
- Heights of structures associated with the pump station will be minimized and not exceed a height of 45 ft.
- Temporary construction easements will be returned to pre-construction conditions and consistent with the 100-year level of risk reduction.
- All project features will be designed so that the visual and human-cultural values associated with the project are protected, preserved, maintained, or enhanced to the maximum extent practicable. Structures will be designed to blend with their physical surroundings, or where contrast is necessary and appropriate, that contrast will improve the environment, to the greatest extent practicable.
- Design structures are to remain open except during storm events of such magnitude that flooding is expected.
- Provide for rapid reopening of structure even if electricity is unavailable.
- Ensure that navigation remains open and safe during construction.
- During construction, the contractor shall be required to maintain navigation channels open and operable for passage of vessels of all types. In deep-draft waterways, safe navigation shall be maintained for one-way traffic of a large ocean-going ship. In shallow-draft waterways, safe navigation shall be maintained for one-way barge traffic.
- Short periods of closure will be allowed with proper notification and coordination with the USCG and marine interests.

Borrow Projects

HSDRRS borrow sites require a Borrow Management Plan, which is submitted to CEMVN by the contractors and describe methods used to limit impacts from borrow excavation due to truck traffic. Some parish ordinances (e.g., Jefferson Parish) establish construction design and post-construction use criteria.

5.3.1.17.2 Specific Socioeconomic Resources and Environmental Justice Mitigation Measures

The Gatién-Navy Camp Hope borrow area (IER #19), located on East St. Bernard Highway is directly adjacent to a cemetery. A buffer zone will be left between the cemetery and the area where excavation is to occur.

5.3.1.18 HTRW Design and Construction Mitigation for HSDRRS and Borrow Impacts

5.3.1.18.1 General HTRW Mitigation Measures

For all HSDRRS construction activities, Phase I ESAs were conducted, and subsequent testing was also performed if determined necessary to determine the location of potential HTRW sites within and proximate to the HSDRRS ROW. Where HTRW sites were discovered, they were avoided during construction activities to the greatest extent practicable. A number of design mitigation measures have been made through inclusion in the solicitation package for design-build projects. These mitigation measures are intended to avoid or minimize the impacts of the HSDRRS actions, to the maximum extent practicable. In addition, construction mitigation measures have been implemented, including the designation of no-work zones, to avoid or minimize disturbance of any contaminated sediments or other HTRW within project areas. Management of petroleum, oils, and lubricants during construction included proper labeling and storage, and utilization in a manner to prevent and avoid spills.

For borrow sites, the contractor will also be required to collect, characterize, label, store, transport, and dispose of all non-recyclable hazardous and regulated wastes, as regulated by the USEPA, and to comply with RCRA and other applicable laws and regulations.

Solid waste receptacles will be maintained at all staging areas. Non-hazardous solid waste (trash and waste construction materials) will be collected and deposited in on-site receptacles. Solid waste will be collected and disposed of properly in accordance with the Solid Waste Disposal Act [P L 89-272, 79 Stat. 997, as amended by RCRA, P L 94-580, 90 Statute 2795 (1976)].

5.3.1.18.2 Specific HTRW Mitigation Measures

A no-work zone in the vicinity of Bayou Trepagnier on both the flood and protected side of the existing levee will be adhered to until Motiva's remediation of contaminants in this area is complete (IER #1 and IER Supplemental #1). As described in IER #18, based on the Phase I ESAs for the Dockville, Belle Chasse, Cummings North, Westbank Site G, Bonnet Carré North borrow sites, evidence of RECs was present at those sites. The locations of these RECs were generally mapped, and all will be avoided by the borrow contractors.

The Phase I ESA for the Tabony borrow site noted HTRW concerns from the former drilling operations of a documented well located in the south-central portion of the site. The location of the well was mapped and will be avoided during excavation (IER #22). The Phase I ESA for the Westbank F site noted RECs associated with illegal dumping along the gravel road at the east side of the property. The locations of the drums were mapped and are outside of the construction footprint (IER #22). In the Phase I ESA for the Westbank I site, concerns were noted from use of lead shot at the adjoining skeet and trap shooting range in the west-central and southern portions of the site and due to former drilling operations at three documented wells. The locations of the RECs were mapped and will be avoided during excavation.

The Phase I ESA for Westbank N noted several RECs on-site. All locations of the RECs were mapped and will be avoided during excavation. The various HTRW issues are as follows:

- On-site concerns were noted from the former drilling operations of a documented well located in the central portion of the subject site.

- On-site concerns were noted from the reported application of herbicide weed killer for at least 10 years over the entire site by the current occupant. Approximately 3 ft of topsoil would be removed by bulldozers during excavation, so any present pesticides would not be found in borrow material.
- On-site concerns were noted from stained soils observed underneath a backhoe located in the northeastern portion of the site.
- On-site concerns were noted from a downed pole-mounted transformer located in the northeastern portion of the site.
- On-site concerns were noted from several 55-gallon drums and 5-gallon containers observed scattered across the north-central portion of the site.
- On-site concerns were noted from an approximately 100-gallon diesel AST observed in the north-central portion of the site.

The Stumpf Phase 2 ESA revealed a historical REC from the former Overnight Transport facility adjacent to the west and one REC from the Recovery One Landfill adjacent to the east. The locations of the RECs were mapped and the areas would be avoided (IER #25). Westbank D borrow site Phase I ESA indicated that the borrow site is located adjacent to the River Birch C&D Landfill and several plugged and abandoned wells from the 1960s and 1970s. Soil sampling is recommended at the well sites and also at the northwest corner of the site, where leachate from the landfill may have affected the site. Soil testing would be done before any excavation proceeds. The locations of the RECs were mapped and the areas will be avoided. The Phase I ESA for Westbank E noted off-site concerns from the current and historical presence of a landfill located on the southwest adjoining property and two plugged and abandoned wells. The locations of the RECs were mapped and the areas will be avoided (IER #25).

The South Kenner Road site is a permitted construction and demolition landfill. The permittee is responsible for complying with the terms and conditions of the landfill permit (IER #26).

As detailed in IER #31, and based on the Phase II ESA, which was performed at the Idlewild Stage 2 borrow site, there are certain measures required due to elevated arsenic levels. If the arsenic in the area of interest does not meet the qualifications to be considered as background levels and does not meet RECAP Corrective Action Approval, then it is recommended that the soil in the area surrounding the former oil well located in the area of temporary monitoring well W-9 be remediated to meet Louisiana RECAP before being used for borrow material. If remediation is needed, it is the responsibility of the landowner to complete prior to use on any CEMVN contract. A CEMVN HTRW specialist will coordinate with the landowner as needed to ensure compliance with contamination standards. If the soil cannot be remediated it will not be used on any CEMVN project.

At the Lilly Bayou borrow site and based on RECs noted in the Phase I ESA, two wells are located on-site, one active and one plugged and abandoned. Per the CEMVN, the areas around the two oil wells should be designated no-work zones (IER #31).

A Phase I ESA at the Nairn borrow area noted that an unknown fill material was located on tract "D." The CEMVN has required that the area composed of unknown fill material be avoided for use as borrow (IER #32).

5.3.2 Future Mitigation Measures

In order to minimize impacts from the design, construction, and operations of the HSDRRS, a commitment was made to a number of mitigation measures based on future conditions. These future mitigation efforts could be needed because:

- a risk reduction feature was not constructed at this time, but may be constructed in the future
- operating requirements of constructed risk reduction structures could have impacts that need to be reduced
- monitoring performed by CEMVN results in data that indicate additional mitigation is needed

No future mitigation commitments were made in IERs #2, #4, #5, #9, #10, #15, or #17.

5.3.2.1 *Water Quality HSDRRS Future Mitigation*

5.3.2.1.1 St. Charles Sub-basin (IER #1 and IER Supplemental #1)

The HSDRRS construction required that once the Bayou Trepagnier drainage structure was permanently closed, the Bayou Trepagnier Pump Station would be operated to achieve the same hydrologic regime (water levels) as previous non-construction conditions to avoid the impoundment or drainage of protected side swamps near the pump station. Also, all gates and/or culverts being replaced or modified should be operated according to previously developed operational plans to avoid further degradation of the project area hydrology. Additionally, to avoid the protected side swamps near the Bayou Trepagnier pumps and drainage structure from becoming impounded or drained, assurances would be provided that once the drainage structure is replaced with a T-wall the pumps would be operated to achieve the same hydrologic results (i.e., water levels) as in the past, thus perpetuating existing conditions and minimizing secondary impacts from development and hydrologic alteration.

5.3.2.1.2 Jefferson East Bank Sub-basin (IER #3 and IER Supplemental #3.a)

All gates and/or culverts being replaced or modified should be operated according to previously developed operational plans to avoid further degradation of the project area hydrology.

5.3.2.1.3 New Orleans East Sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain and #11 Tier 2 Borgne, IER Supplemental #6, IER Supplemental #7, and IER Supplemental #11 Tier 2 Borgne)

Per IER #6, if practicable, any dredged material excavated for construction of the access channels determined to be in excess of what is required to refill the channels should be used beneficially. Placement along the south shore of Lake Pontchartrain adjacent to the foreshore rock protection will likely hasten emergent marsh habitat establishment. At this time it is anticipated that all dredged material excavated for construction of access channels will be utilized to refill the dredged channels. However, if it is determined that excess material is excavated during dredging of access channels, the CEMVN will consider using the excess dredged material along the south shore of Lake Pontchartrain to raise the elevation and improve conditions for emergent marsh habitat establishment.

Access channels should be refilled to the prior lake bed elevation after project construction, especially the channel sections in water depths of 3 ft or less. In areas shallower than 3 ft, where preexisting elevations have not been successfully restored, those elevations would be restored by additional measures. All efforts will be made to restore lake bottom elevations to their original

grade. Post-construction lake bottom elevation surveys will be conducted, and survey results will be provided to the natural resource agencies.

As detailed in IER #11 Tier 2 Pontchartrain, during operations and maintenance activities for the HSDRRS project components, the following mitigation measures would occur:

- During coordination with the resource agencies in the development of the Water Control Plan and operations and maintenance plans, partial opening scenarios and coordination of closure events to minimize impacts on resources will be considered. Specifically, the flood risk reduction water control structures should remain completely open except during storm events. Although this scenario may not be possible, operation and maintenance of this and other gates within the structure should attempt to minimize closure frequency and duration.
- The OMRR&R plans should be developed to keep the cross-sectional area open for as long as possible and should be coordinated with the natural resource agencies.
- Monitoring will be conducted to obtain observed rather than predicted DO data. If the results of this monitoring demonstrate the need for modeling and/or actions to address adverse impacts, the CEMVN will coordinate with the resource agencies to complete modeling, within authorization and funding, to evaluate alternatives for providing rectification and/or mitigation to offset adverse impacts. The outcome of the monitoring and modeling will be disclosed in any future CED supplements and the Mitigation IERs, and will include overall cumulative impacts, including those associated with project operations and maintenance cumulative impacts.

Per IER #11 Tier 2 Borgne, the resource agencies requested that flood risk reduction water control structures should remain completely open except during storm events, and that the GIWW bypass swing gate should be positioned in the floating position during non-storm operating conditions to allow for maximum flows through the structure. Although this scenario may not be possible, operation and maintenance of this and other gates within the Borgne barrier project should attempt to minimize closure frequency and duration. Additionally, operational plans should be developed to keep the cross-sectional area open for as long as possible.

5.3.2.1.4 Chalmette Loop Sub-basin (IERs #8, #9, and #10)

The flood risk reduction water control structures shall remain completely open except during storm events. Management of those structures should be coordinated with the USFWS, NMFS, LDWF, and LDNR. The structure would be operated per the final OMRR&R plan and water control plan. In general, the standing instructions for all the water control structures would be to remain open except during storms and high tides. During a storm event, the gate would be closed to provide flood risk reduction.

5.3.2.1.5 Belle Chasse Sub-basin (IER #13) and Lake Cataouatche Sub-basin (IER #16)

Flood risk reduction water control structures should remain completely open except during storm events, unless otherwise determined by the resource agencies. However, the plan of operations for the water control structures will be outlined in the OMRR&R manual which will be provided to the non-Federal sponsors. The structures are to remain open except during tropical events. Any changes to the OMRR&R manual recommended by either the non-Federal sponsor or the resources agencies will have to be approved by the CEMVN.

5.3.2.1.6 Gretna-Algiers Sub-basin (IER #12)

A maintenance dredging management plan for material dredged from the Algiers Canal should be developed for the life of the IER #12 project. Adaptive management efforts will occur and project feature augmentations would be implemented to minimize adverse impacts within the Bayou aux Carpes CWA Section 404(c) area (as discussed in section 5.3.2.7.1). Additionally, flood risk reduction water control structures should remain completely open except during storm events, unless other specific modifications of the Estelle outfall canal are identified during augmentation development or adaptive management of augmentations.

5.3.2.2 Wetlands HSDRRS Future Mitigation

5.3.2.2.1 Belle Chasse Sub-basin (IER #13) and Gretna-Algiers Sub-basin (IER #12)

A report documenting the status of mitigation implementation and maintenance should be prepared every 3 years and provided to the CEMVN, USFWS, NMFS, USEPA, LDNR, and LDWF. That report should also describe future management activities and identify any proposed changes to the existing management plan.

5.3.2.2.2 New Orleans East Sub-basin (IERs #6, #7, IER Supplemental #6, and IER Supplemental #7)

No dredging for foreshore protection improvements occurred during the 2011 HSDRRS construction. However, for any future in-water work, a pre- and post-construction bathymetric survey, and SAV populations survey will be conducted to document percent occurrences of aquatic plants in or near the construction area. If post-construction surveys do not show a natural revegetation of the area, plantings of SAV will occur to return the site to pre-construction conditions. Appropriate mitigation should be coordinated with the Interagency Team.

The recovery of the SAV beds in the shallower portions (i.e., less than 3 ft depth) of Lake Pontchartrain from the western end of the IER #6 project to 6,000 ft east of Paris Road would be monitored (IER #7). If the SAV has not recolonized to pre-project conditions within 1 year following backfilling, appropriate species of SAV would be planted in the project area. Coordination with USFWS, NMFS, and other interested natural resource agencies should be conducted to determine the adequacy of recovery and planting specification, if needed. Currently, it is anticipated that pre-and post-construction bathymetric and SAV population surveys would be conducted to document percent occurrences of aquatic plants in or near the construction area. If post-construction surveys do not indicate natural SAV recolonization, SAV plantings would occur in order to return the site to pre-construction conditions to the greatest extent practicable. The CEMVN will work with the Interagency Environmental Team and local Lake Pontchartrain interest organizations to restore lake bottom habitat.

5.3.2.3 Fisheries HSDRRS Future Mitigation

5.3.2.3.1 New Orleans East Sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain and #11 Tier 2 Borgne, IER Supplemental #6, IER Supplemental #7, and IER Supplemental #11 Tier 2 Borgne)

In order to minimize impacts on fisheries migration and flow, the monthly maintenance activities should coincide with closure events intended to reduce velocities for the maritime industry, to the maximum extent practicable. In the event that this is not feasible, closures should be timed to coincide with the two low tidal periods of the month in order to minimize impacts on fisheries migration and flow.

5.3.2.4 Threatened and Endangered Species HSDRRS Future Mitigation

5.3.2.4.1 New Orleans East Sub-basin (IERs #6, #7, #11 Tier 2 Pontchartrain, IER Supplemental #6, and IER Supplemental #7)

Work that was originally proposed for foreshore protection as described in in IERs #6 and #7 was not needed to meet the current 100-year level of risk reduction and therefore was not performed. However, this work may be done in the future (prior to 2057) to maintain the risk reduction level. Should this work for foreshore protection be implemented, the following future mitigation measures would occur to minimize impacts on Gulf sturgeon:

- A bucket dredge will be used to excavate nine 10 ft deep channels perpendicular to the shoreline of Lake Pontchartrain, ranging from 750 to 1600 ft long and up to 400 ft wide, in order to access the foreshore protection area for rock placement. Four 2,000 by 500 ft wide lateral access channels parallel to the shoreline will also be dredged. Dredging would only occur May through September in order to avoid impacts on Gulf Sturgeon that may use Lake Pontchartrain as winter foraging habitat.
- Dredged material will be stockpiled adjacent to the channels (with a 14 to 40 ft buffer in between) and surrounded with a siltation curtain to keep it in place. All dredged material will be returned to the access channels once the project is completed.

Specific future mitigation measures outlined in IER #11 Tier 2 Pontchartrain detailed the following:

- The OMRR&R plans should inform the local non-Federal sponsor of the potential for Federally listed threatened and endangered species to occur near the structures and the need to be aware of their presence during operation of those structures. The CEMVN will include in the OMRR&R plan to be provided to the non-Federal sponsor, a measure that will inform them of the need to coordinate with the USFWS and NMFS every year and when operational plans are revised, as those revisions may affect Federally listed threatened and endangered species.
- The OMRR&R plans developed for the local non-Federal sponsor will include Standard Manatee Protection Measures to ensure that manatees are not entrapped or harmed within the flood risk reduction structures during the closure of the structures.

5.3.2.5 Recreational Resources HSDRRS Future Mitigation

5.3.2.5.1 Harvey-Westwego Sub-basin (IERs #14 and #15)

Any future changes to any reach described in IER #14 and IER #15 that may impact NPS lands or flood-side wetlands should examine alternatives on a sub-reach basis to ensure that all feasible alternatives have been examined. That analysis should be coordinated with the NPS, the USFWS, and other natural resource agencies. Future maintenance and associated activities (e.g., staging areas, access routes, pipeline lowerings) should be identified, planned, and coordinated with the JLNHPP staff to avoid future potential impacts on NPS lands.

5.3.2.6 Monitoring

Long-term monitoring data, results, and information were to be included in the CED. Although noted as data gaps in specific IER documents, many of these future mitigation measures have not been completed. In fact, monitoring efforts required to minimize adverse impacts on natural resources will not be completed until 2013 or in the case of the Bayou aux Carpes CWA 404(c) area, monitoring would continue for 50 years. Data that have been collected through the monitoring program are included in appendix G. Other phases or supplements of the CED will include long-term monitoring and analysis data not available at this time.

For the IER #14 Bayou aux Carpes 404(c) area, a monitoring plan was to be developed. That monitoring plan would address hydrologic, nutrient, and contaminant changes. Specifically, if hydraulic modeling demonstrates that environmental augmentation features are beneficial, operational plans to maximize freshwater detention or redirect freshwater flows into the Bayou aux Carpes CWA Section 404(c) area should be coordinated with the natural resource agencies, especially USEPA and NPS.

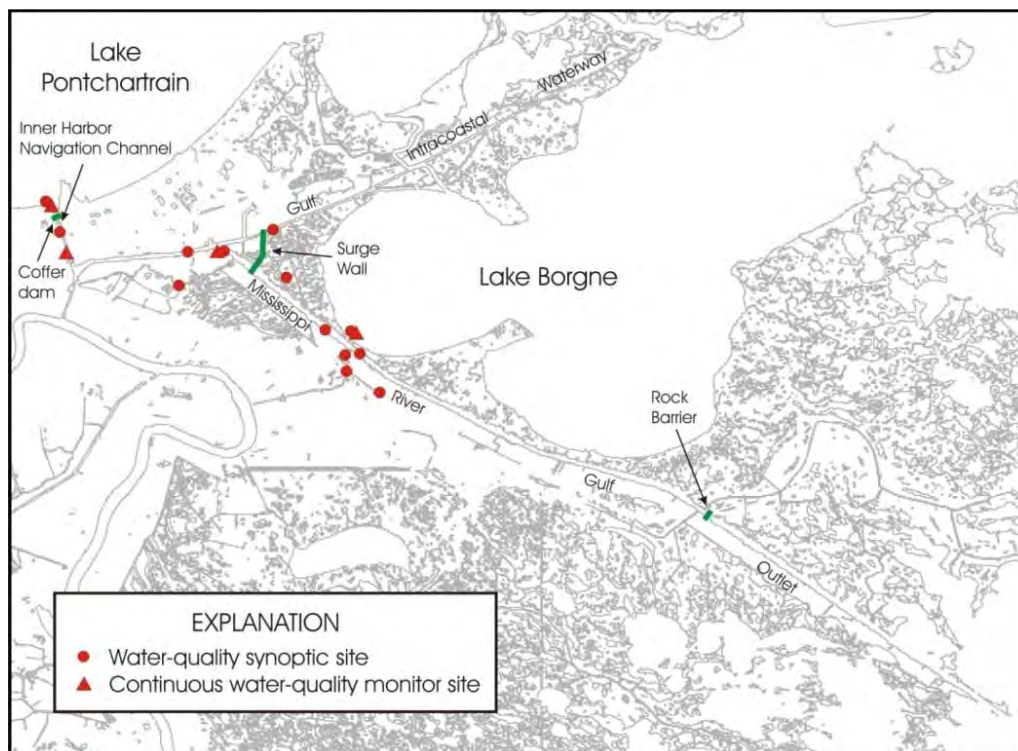
5.3.2.6.1 Specific Monitoring Measures

New Orleans East Sub-basin (IERs #7 and Supplemental #7, #11 Tier 2 Pontchartrain)

A breakwater foreshore protection along the Lake Pontchartrain shoreline is proposed to be raised in elevation to provide protection of the levee against wave forces (LPV-108). IER #7 indicated that, prior to the construction of the foreshore/breakwater protection along this portion of the HSDRRS alignment, surveys of SAV were to be conducted to determine EFH mitigation requirements for the SAV. If it is determined that the breakwater along the Lake Pontchartrain shoreline, as originally proposed in IER #7, would require an elevation increase, the pre- and post-survey protocol for the SAV would be implemented at that time.

In IER #11 Tier 2 Pontchartrain, the CEMVN committed to further consider partial opening scenarios and coordination of closure events to minimize impacts on resources, as stated in the signed Decision Record. The CEMVN is funding the USGS to conduct monitoring to obtain observed DO data. A water quality monitoring site within the MRGO was established in August 2008, prior to the construction of the HSDRRS rock barrier in June 2009, which focuses on DO concentrations. The monitoring program was expanded to monitor near two additional barriers in MRGO, the GIWW, and the IHNC. There are presently six water quality monitoring stations located in the IHNC basin, which are shown in figure 5-2.

Figure 5-2. Water Quality Monitoring Sites for the MRGO, the GIWW, and IHNC (IER #11 Tier 2 Pontchartrain)



Note: From USGS Monitoring Work Plan, June 30, 2010.

Monitoring will consist of approximately 3 years of data, and will result in an interpretative report in 2013. The monitoring is conducted nine times throughout each year along seven transects through the waterways and in six single vertical measurement sites in the wetlands near the barriers. Continuous monitoring will also occur in four areas within the MRGO, IHNC, and Lake Borgne. The data collected and reported will have both temporal and spatial components. The monitoring is from both pre- and post-construction of these barriers and is to be conducted above and below the barriers. This effort was reviewed and coordinated with the Interagency Team. Should this monitoring data illustrate a need for modeling or other actions required to address adverse impacts, the CEMVN will then coordinate the modeling to evaluate alternatives to rectify or mitigate the adverse impacts.

Gretna – Algiers Sub-basin (IER #12)

On November 4, 2008, the CEMVN requested a modification of the 1985 Bayou aux Carpes CWA Section 404(c) final determination to allow for discharges into the Bayou aux Carpes CWA Section 404(c) area, and on May 28, 2009, this request was granted.

In order to accommodate changing goals and restoration needs, the water control structures should be designed to incorporate operational flexibility through an adaptive management program. In general, an adaptive management policy is one that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. As part of the HSDRRS project, proposed augmentations are being evaluated to determine if their implementation would be beneficial to maintaining the high-quality habitat of the Bayou aux Carpes CWA Section 404(c) area. Potential augmentation features include gapping the southern bankline of the Old Estelle outfall canal, modifying of the canal berm along the Southern Natural Gas Pipeline Canal, modifying of the shell plug, and gapping or grading of oil and gas key-hole canal banks while also lowering the grade of the oil well access service roads in the area. The concept for all these features is to aid in the reestablishment of the natural hydrologic flow and tidal exchange within the Bayou aux Carpes CWA Section 404(c) complex area.

However, to determine the potential benefits of the proposed augmentations, monitoring and modeling are ongoing. Currently there are two short-term efforts under way to determine how to move forward with the augmentation features, and include the monitoring and modeling of the Bayou aux Carpes CWA 404c site. The following describes these two short-term efforts:

- 1) A USGS water quality assessment. The water quality assessment, which started in late 2009, is still underway. The USGS water quality assessment consists of three components: (1) quarterly pore water sampling (along with other parameters, such as low-level nutrients) and soil quality analysis performed at four locations; (2) surface water quality sampling at the Estelle Pump Station and within the associated canal itself, performed one to two days after a major rainfall event; and (3) the establishment of two continuous monitoring water quality stations to aid in discerning inundation hydraulic gradients.

The status as of March 2012 is as follows:

- a.) Pore water sampling was performed for the first two quarters of 2010, while no further data were collected for the third and fourth quarters due to damage of the water gauges. The USACE provided funding to repair the water gauges and continue the water quality assessment, and the gauges were replaced in early 2011.
- b.) Water level recording devices were purchased and will be placed on-site at the next available opportunity.

- c.) Soil samples were collected and processed, and analysis is ongoing.
 - d.) The runoff sampling for the herbicide/pesticide assessment was conducted in March 2012.
- 2) Hydraulic and Hydrologic modeling. The Vicksburg District began hydraulic and hydrologic modeling of the flow regime in the area in 2007. Initial presentation of flowpath simulations were presented in 2008. The Light Detection and Ranging (LiDAR) data indicated some suspect areas with elevations of 3 to 4 ft. The flow simulation work was stopped until the data set outliers could be resolved, and between 2009 and 2010 no additional modeling work was done. Surveying was completed in December 2011, and the flow simulation modeling activities have been restarted. The modeling is currently in the process of being completed. The model simulates baseline conditions and then models the proposed augmentations with the IER #12 project features in place to observe any potential in changing water flow regimes. Simulations specifically consist of:
- Baseline conditions without structure,
 - Baseline conditions with structure open,
 - Baseline conditions with structure closed,
 - Gapping the spoil bank along the old Estelle outfall canal southern bank,
 - Plugging the Southern Natural Gas Pipeline,
 - Opening the Bayou aux Carpes CWA Section 404(c) plug,
 - Simultaneously opening the Southern Natural Gas Pipeline and Bayou aux Carpes CWA Section 404(c) canal,
 - Gapping the Southern Natural Gas Pipeline spoil bank, and
 - Variations of all the above scenarios to determine the optimum conditions to best restore natural flow regimes within the Bayou aux Carpes CWA Section 404(c) area.

The current status is:

- a.) Data review is complete, and data set errors have been identified.
- b.) ERDC will conduct on-site surveys to correct elevation data.
- c.) The data have been corrected and simulations are under development. When the simulations are completed, the modeling results will be presented to the interagency team for review.

The USGS monitoring and Vicksburg District modeling will be used to determine which augmentation/enhancement features would be beneficial. The meeting with the Interagency Team will review those alternatives and develop a plan for implementing a preferred alternative (based on the potential for success and positive benefits for the augmentations).

IER #12 described that once the augmentation was selected and constructed a long-term monitoring plan would be developed and implemented to monitor the Bayou aux Carpes CWA Section 404(c) area and ensure that adverse impacts on the Bayou aux Carpes 404c CWA site were avoided. Long-term monitoring would be performed in conjunction with augmentation adaptive management. Since the water quality and hydrologic modeling were delayed, the development and implementation of the long-term monitoring began prior to the construction of any augmentation feature.

The USFWS began long-term monitoring on the Bayou aux Carpes CWA 404c site in 2010. A vegetative sampling plan that monitors species composition and relative abundance was implemented at five plots within the Bayou aux Carpes CWA Section 404(c) area in forested habitat types. The number of sites may be expanded to include a control site outside of the Bayou aux Carpes CWA 404c site. Sampling was proposed to occur on a biannual basis and provide the following monitoring goals: (1) identification of existing hydrologic patterns and any changes to these patterns; (2) identification of any changes to existing forest stand structure and production as a result of the enhancements; (3) changes in canopy tree basal growth; and (4) recruitment of cypress and tupelo trees. Additional monitoring would include an NPS lead amphibian survey and LDNR aerial bird surveys.

To date, a total of six monitoring sites have been established. Four monitoring sites were located mid-year 2010 and two additional sites were established in 2011. Two sampling events occurred; the first occurred in mid-year 2010 and the second on October 24 and 25, 2011. Vandalism of one of the sampling sites was observed during the 2011 sampling event. That site will need to be reestablished (figure 5-3). LDNR has completed two aerial bird surveys, one in 2010 and one in 2011, of nests and rookeries (bald eagles and wading birds) during their respective nesting activity windows. Additional aerial surveys are anticipated and data collected during those surveys will be utilized as part of the long-term monitoring.

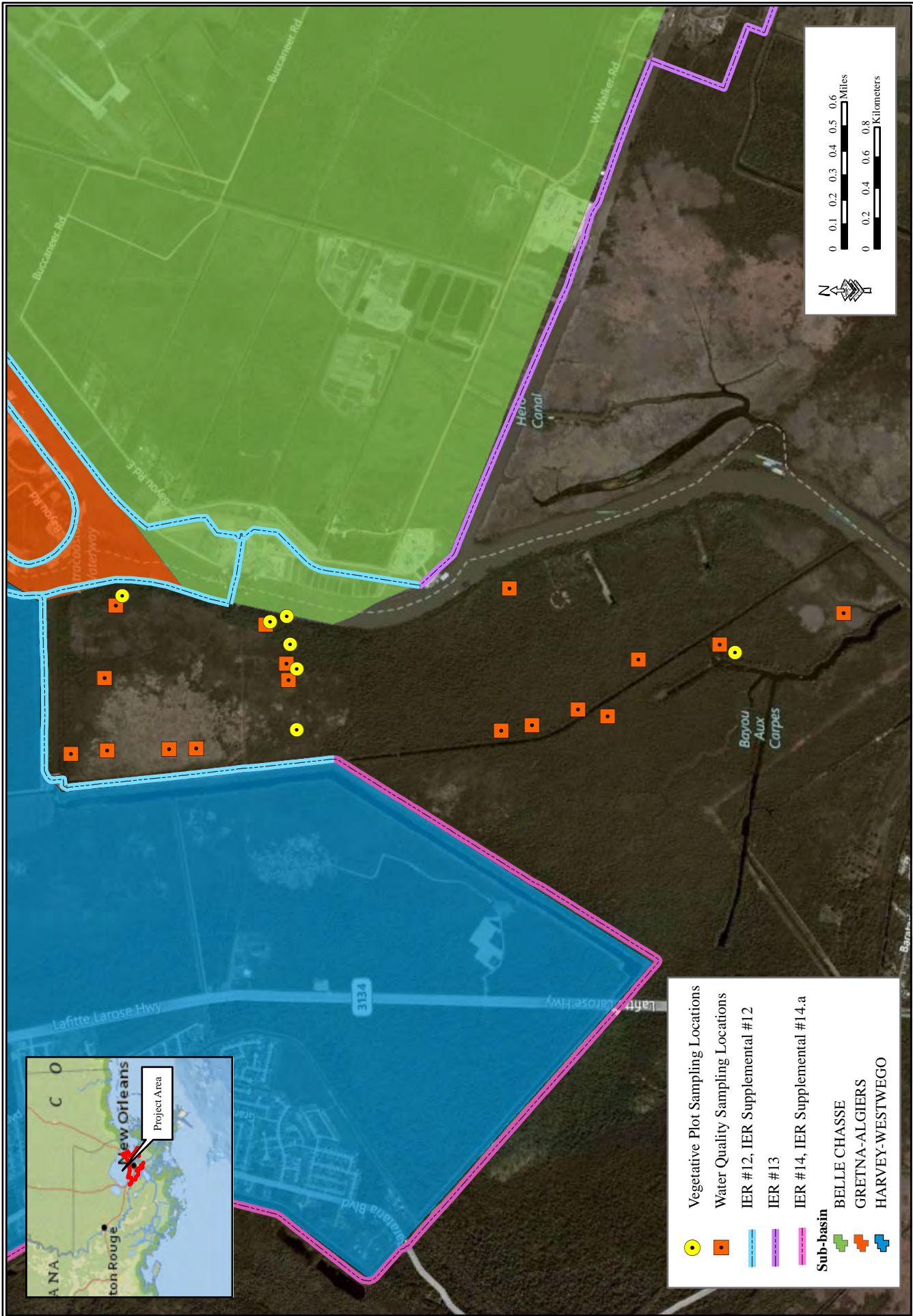


Figure 5-3: Bayou aux Carpes CWA Section 404(c) Sampling Locations

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SECTION 6.0
COORDINATION AND CONSULTATION



6.0 COORDINATION AND CONSULTATION

With the very large five-parish HSDRRS effort came the necessity to have substantial public awareness, agency and public coordination, and cooperation. Extensive public involvement and agency coordination and cooperation has been sought in preparing the IERs and this draft CED. Additional IERs and IER Supplementals are being prepared and will be included in future supplements to the CED. All future IERs and supplements to the CED will continue with the coordination and consultation activities described in section 6.0.

6.1 PUBLIC INVOLVEMENT

Public involvement in the NEPA planning process is standard practice for the USACE, and CEMVN has a process in place to communicate proposed projects and their impacts to the public. However, the size and timeline for completion of the HSDRRS required CEMVN to greatly expand upon the public involvement framework previously established for projection planning. Further, CEMVN recognized that public involvement was a key component to the success of HSDRRS planning efforts. To maximize public opportunity to access information and provide input, the CEMVN utilized public meetings, partnering sessions, special presentations, field trips, workshops, and websites.

The public involvement process began on March 13, 2007, when the USACE published the NEPA Alternative Arrangements in the *Federal Register* and described what the IERs and this document, the CED, entailed. Public involvement continued and was actively sought during preparation of the IERs and this draft CED using www.nolaenvironmental.gov, mailing lists, and news releases. Scoping for the HSDRRS and the NEPA Alternative Arrangements process continued in March 2007 through the placement of advertisements and public notices in the *USA Today* and the *New Orleans Times-Picayune*. Nine public scoping meetings were held throughout the Greater New Orleans Metropolitan Area detailing the HSDRRS scope and the Alternative Arrangements process for implementing the NEPA between March 27 and April 12, 2007, after which there was a 30-day scoping period for public comment submission in which the general public, Federal and state agencies, and non-governmental organizations could provide input. Additionally, a scoping meeting for the CED was held at CEMVN on September 2, 2009. The scoping meeting summaries are provided in appendix E.

Since March of 2007, there have been approximately 200 public meetings about the proposed HSDRRS work in the Greater New Orleans Metropolitan Area. In addition, the CEMVN sent out public notices in local and National newspapers, news releases (routinely picked up by television and newspapers in stories and scrolls), e-mails, and mail notifications to stakeholders for each public meeting. To aid in keeping all the vast information for such a large public involvement effort together, a website called www.nolaenvironmental.gov was set up to be the clearinghouse for all public notices and documents for all of the HSDRRS proposed work. Each draft IER was posted on the www.nolaenvironmental.gov website for a 30-day public review in which the public and Federal and state agencies provided comments on the IER. CEMVN responded to public comments on draft IERs. Additionally, on the CEMVN website at www.mvn.usace.army.mil, there was specific design information for the HSDRRS project in the Greater New Orleans Metropolitan Area, as well as information for other flood risk reduction programs in southeast Louisiana. These efforts include:

- Over 150 press releases regarding the NEPA Alternative Arrangements environmental documents.

- A calendar on the www.nolaenvironmental.gov website allowed for individuals to know when public meetings for particular documents were scheduled and when documents were going out for public comment.
- IER draft and final documents, as well as other supporting documents such as CWA 404(b)(1) analyses, were available for viewing and downloading to aid individuals in being a part of the planning process for the HSDRRS.
- A total of 200 public meeting, workshops, and scoping meetings were held to discuss various portions of the HSDRRS project, while the CEMVN also held numerous interagency and scoping meetings.
- Field trips were held to show the public and resource agencies the location and design of various HSDRRS project features; over 6,500 field trips were hosted by CEMVN.
- Electronic versions of newsletters, entitled *Task Force Hope Status Report*, were available on the www.mvn.usace.army.mil website and generally published twice per month. Since 2006, over 94 newsletters (Task Force Hope Status Report) highlighting the upcoming HSDRRS efforts have been made available on www.mvn.usace.army.mil and distributed to the public at public meetings.
- Videos and animations were created for a multitude of projects which ranged in subject matter from incorporating non-Federal levees and stormproofing of pump stations to the Seabrook floodgate alternatives and the Borgne barrier. These videos and animations are made available on www.nolaenvironmental.com.

The CEMVN hosted monthly public meetings since 2007 at publicly accessible locations throughout the Greater New Orleans Metropolitan Area to keep the stakeholders advised of project status. Additionally, the following was provided for each specific IER Proposed Action on www.nolaenvironmental.gov:

- notice of the draft public comment period
- notice of, at a minimum, one public meeting, although many IER Proposed Actions had four or five public meetings
- PowerPoint presentation of the public meeting
- fact sheet of the IER Proposed Action status
- meeting summary of public comments
- CWA 404(b)(1) evaluation public comment notification, if applicable.

Once an IER Decision Record was signed and construction began, the CEMVN then began to transition the IER information and status meetings into construction update meetings. The public was also able to provide verbal comments during the meetings and written comments after each meeting in person, by mail, and via www.nolaenvironmental.com. Other ways that the CEMVN has kept the HSDRRS project area residents informed of construction and IER Proposed Actions drafted after 2008 have also included:

- email - with the AskTheCorps@usace.army.mil;
- use of social networking sites such as Facebook™ and Twitter™;

- a site on flickr®, a photo sharing website which hosts photographs of the ongoing HSDRRS project construction work; and
- a construction impact hotline (the telephone number is 877-427-0345) presented in mailings and public meetings and often passed out on magnetic stickers for use by residents within the project area.

As part of the overall public involvement effort, the CEMVN has described how hurricane and storm damage risk reduction can be provided in the Greater New Orleans Metropolitan Area. However, part of the message is that all risk cannot be eliminated and that everyone shares responsibility for reducing risk through insurance purchase, zoning and building codes, coastal protection and restoration, and complying with mandatory evacuations. The HSDRRS is only a component of risk reduction.

6.2 AGENCY COORDINATION

Preparations of each IER and this draft CED have been coordinated with appropriate Congressional, Federal, state, and local interests, as well as environmental groups and other interested parties. An Interagency Team was established for each component of the new 100-year level of risk reduction (the HSDRRS) in which Federal and state agency staff played an integral part in the project planning and alternative analysis phases of the project (members of this team are listed in appendix J). This Interagency Team was integrated with the CEMVN PDT to assist in the planning of each project.

Monthly meetings with resource agencies were also held concerning all IER projects. The agencies listed in table 6-1, as well as other interested parties, are receiving copies of this draft CED.

Table 6-1. Agencies Consulted or Coordinated with during the HSDRRS Implementation

Federal	State	Local
Federal Emergency Management Agency	Coastal Protection and Restoration Authority of Louisiana	Jefferson Parish
Natural Resources Conservation Service	Department of Cultural, Recreation, and Tourism	Orleans Parish
National Park Service	Department of Environmental Quality	Orleans Levee District
National Ocean Atmospheric Association	Department of Health and Hospitals	Plaquemines Parish
NOAA National Marine Fisheries Service	Department of Natural Resources	Port of New Orleans
U.S. Coast Guard	Department of Transportation and Development	St. Bernard Parish
U.S. Environmental Protection Agency	Department of Wildlife and Fisheries	St. Charles Parish
U.S. Fish and Wildlife Service	Governor's Executive Assistant for Coastal Activities	Office of the Mayor of New Orleans
Federal Highways Administration	State Historic Preservation Officer	New Orleans Sewerage and Water Board
U.S. Geological Survey	Offices of Senators Vitter and Landrieu	

Typical coordination included:

- LDNR concurrence with the determination that the HSDRRS Proposed Action was consistent, to the maximum extent practicable, with the Louisiana's Coastal Zone Management Program

- receipt of a CWA Section 401 Water Quality Certification from LDEQ
- public review of the Section 404(b)(1) Public Notice and signature of the Section 404(b)(1) Evaluation
- coordination and Section 106 consultation with the Louisiana SHPO
- coordination and Section 106 consultation with affected Native American Tribes
- receipt and resolution of all Fish and Wildlife Coordination Act recommendations
- receipt and resolution of all LDEQ comments on the air quality impact analysis documented in each IER
- receipt and resolution of all EFH recommendations
- interested parties coordination under NEPA
- concurrence from USFWS that the HSDRRS Proposed Action was not likely to adversely affect the endangered or threatened species under its jurisdiction
- concurrence from NMFS that the HSDRRS Proposed Action was not likely to adversely affect any endangered or threatened species under its jurisdiction

Formal initial coordination began with USFWS early in 2007, and the CEMVN received a draft programmatic CAR from USFWS on November 26, 2007 (appendix Q). The programmatic CAR contains specific recommendations for minimizing adverse impacts on the natural environment from the entire HSDRRS project. The CEMVN utilized these USFWS programmatic recommendations when designing the HSDRRS IER Proposed Actions, to the greatest extent practicable. The USFWS's programmatic recommendations and the CEMVN's response to them, including how they are addressed in the CED, are listed below:

Recommendation 1: To the greatest extent possible, situate flood risk reduction so that destruction of wetlands and non-wet BLH are avoided or minimized.

CEMVN Response 1: The project will utilize the authorized level of risk reduction footprint and minimize impacts on wetlands.

Recommendation 2: Minimize enclosure of wetlands with new levee alignments. When enclosing wetlands is unavoidable, acquire non-development easements on those wetlands, or maintain hydrologic connections with adjacent, unenclosed wetlands to minimize secondary impacts from development and hydrologic alteration.

CEMVN Response 2: Enclosure of wetlands will be avoided to the greatest extent practicable, unless the wetlands are currently isolated. In some instances where wetlands are currently isolated (i.e., they do not have hydrologic connections with adjacent wetlands), and the wetlands are small and of low quality, they may be enclosed and hydrologic connections lost.

Recommendation 3: Avoid adverse impacts on bald eagle nesting locations and wading bird colonies through careful design project features and timing of construction.

- CEMVN Response 3: Concur.
- Recommendation 4: Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts on nesting migratory birds, when practicable.
- CEMVN Response 4: This recommendation will be considered in the design of the project to the greatest extent practicable.
- Recommendation 5: The project's first PCA (or similar document) should include language that includes the responsibility of the local cost-sharer to provide operational, monitoring, and maintenance funds for mitigation features.
- CEMVN Response 5: PPA does not contain language requiring the non-Federal Sponsor to provide certification of sufficient funding for the entire project. Further, mitigation components are considered a feature of the entire project. The non-Federal Sponsor is responsible for OMRR&R of all project features in accordance with the OMRR&R manual that the USACE provides upon completion of the project.
- Recommendation 6: Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the USFWS, NMFS, LDWF, USEPA, and LDNR. The USFWS shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.
- CEMVN Response 6: Concur.
- Recommendation 7: The CEMVN should avoid impacts on public lands, if feasible. If not feasible, the CEMVN should establish and continue coordination with agencies managing public lands that may be impacted by a project feature until construction of that feature is complete and prior to any subsequent maintenance. Points of contacts for the agencies overseeing public lands potentially impacted by project features are: Kenneth Litzenberger, Project Leader for the USFWS' Southeast National Wildlife Refuges, and Jack Bohannon (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR, Office of State Parks contact Mr. John Lavin at 1-888-677-1400, NPS contact Haigler "Dusty" Pate, (504) 589-3882, extension 119 (haigler_pate@nps.gov), or Chief of Resource Management David Muth (504) 589-3882, extension 128 (david_muth@nps.gov) and for the 404(c) area's contact the previously mentioned NPS personnel and Ms. Barbara Keeler (214) 665-6698 with the USEPA.
- CEMVN Response 7: Concur.
- Recommendation 8: If applicable, a General Plan should be developed by the CEMVN, the USFWS, and the managing natural resource agency in accordance with Section 3(b) of the Fish and Wildlife Coordination Act for mitigation lands.
- CEMVN Response 8: Concur.

Recommendation 9: 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 I (to the draft Fish and Wildlife Coordination Act Report). 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.

CEMVN Response 9: Concur.

Recommendation 10: If a proposed project feature is changed significantly or is not implemented within 1 year of the date of the Endangered Species Act consultation letter, the USFWS recommended that the Corps reinitiate coordination to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their habitat.

CEMVN Response 10: Concur.

Recommendation 11: In general, larger and more numerous openings in a risk reduction levee better maintain estuarine-dependent fishery migration. Therefore, as many openings as practicable, in number, size, and diversity of locations should be incorporated into project levees.

CEMVN Response 11: Concur.

Recommendation 12: Flood risk reduction water control structures in any watercourse should maintain pre-project cross-sections in width and depth to the maximum extent practicable, especially structures located in tidal passes.

CEMVN Response 12: Concur.

Recommendation 13: Flood protection water control structures should remain completely open except during storm events. Management of those structures should be developed in coordination with the USFWS, NMFS, LDWF, and LDNR.

CEMVN Response 13: Concur.

Recommendation 14: Any flood protection water control structure sited in canals, bayous, or a navigation channel which does not maintain the pre-project cross-section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel, as well as an opening in the center of the channel that extends to the bottom.

CEMVN Response 14: Concur.

Recommendation 15: The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

CEMVN Response 15: Concur.

Recommendation 16: Flood risk reduction structures within a waterway should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

CEMVN Response 16: Concur.

Recommendation 17: To the maximum extent practicable, structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 ft/s. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.

CEMVN Response 17: Concur.

Recommendation 18: To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts selected should maintain sufficient flow to prevent siltation.

CEMVN Response 18: Concur.

Recommendation 19: Culverts should be installed in construction access roads unless otherwise recommended by the natural resource agencies. At a minimum, there should be one 24-inch culvert placed every 500 ft and one at natural stream crossings. If the depth of water crossings allow, larger-sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500 ft long and an area would hydrologically be isolated without that culvert.

CEMVN Response 19: Concur.

Recommendation 20: Water control structures should be designed to allow rapid opening in the absence of an off-site power source after a storm passes and water levels return to normal.

CEMVN Response 20: Concur.

Recommendation 21: Levee alignments and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

CEMVN Response 21: Concur.

Recommendation 22: Operational plans for water control structures should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

CEMVN Response 22: Concur.

Recommendation 23: CEMVN shall fully compensate for any unavoidable losses of wetland habitat or non-wet BLH caused by project features.

CEMVN Response 23: Concur.

Recommendation 24: Acquisition, habitat development, and maintenance and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the CEMVN shall provide the necessary funding to ensure that mitigation obligations are met on behalf of the public interest.

CEMVN Response 24: Construction of the project features is cost-shared between the Federal Government and non-Federal sponsor. However, costs for operation, maintenance, repair, replacement, and rehabilitation will be the responsibility of the non-Federal sponsor.

Recommendation 25: Any proposed change in mitigation features or plans should be coordinated in advance with the USFWS, NMFS, LDWF, USEPA, and LDNR.

CEMVN Response 25: Mitigation for the impacts caused by this project would be coordinated through mitigation IERs. Any material changes to the mitigation plan in this IER would be coordinated in advance.

Recommendation 26: A report documenting the status of mitigation implementation and maintenance should be prepared every 3 years by the managing agency and provided to the CEMVN, USFWS, NMFS, USEPA, LDNR, and LDWF. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

CEMVN Response 26: Concur.

In addition to the 2007 programmatic CAR from the USFWS for the system-wide HSDRRS effort, each HSDRRS IER and IER supplemental document had a CAR that accounted for the impacts of its proposed action. The CEMVN incorporated the USFWS's programmatic recommendations into project design studies to the extent practicable, so that they were consistent with engineering constraints, as well as ensuring public safety requirements. While the programmatic CAR contained recommendations for minimizing adverse impacts on the natural environment from the entire HSDRRS project, the final CAR made recommendations to minimize adverse impacts on the natural environment for each IER proposed action. Table 6-2 lists the signature date for each Final CAR. Again, as with the Programmatic CAR, USFWS coordinated all final IER-specific CARs with NMFS and LDWF, and incorporated their comments.

Table 6-2. Listing of USFWS Final CARs and Dates Signed

IER/IER #¹	Title of Final USFWS CAR	Final CAR Signatory Date
1	CAR for IER Lake Pontchartrain and Vicinity, St. Charles Parish, Louisiana (IER #1)	January 14, 2008
2	CAR for IER Lake Pontchartrain and Vicinity West Return Floodwall, Jefferson and St. Charles parishes, Louisiana (IER #2)	July 15, 2008
S 2	CAR for Supplemental IER Lake Pontchartrain and Vicinity West Return Floodwall, Jefferson and St. Charles parishes, Louisiana (IERS #2)	September 9, 2009
3	CAR for IER Lake Pontchartrain and Vicinity Jefferson East Bank, Jefferson, Louisiana (IER #3)	July 21, 2008
4	CAR for IER Lake Pontchartrain and Vicinity Orleans East Bank, New Orleans, Louisiana (IER #4)	March 6, 2009
5	CAR for Lake Pontchartrain and Vicinity Outfall Canal Closure Structures, 17 th Street Canal, Orleans Avenue Canal and London Avenue Canal, Orleans and Jefferson Parish, Louisiana (IER #5)	June 6, 2009
6	CAR for IER Lake Pontchartrain and Vicinity Orleans Parish, Louisiana (IER #6)	May 29, 2009
S 6	CAR for Supplemental IER Lake Pontchartrain and Vicinity Orleans Parish, Louisiana (IERS #6)	January 22, 2010
7	CAR for IER #7 New Orleans East Lakefront to Michoud Canal, Orleans Parish, Louisiana	June 15, 2009
S 7	CAR for Supplemental IERS #7 New Orleans East Lakefront to Michoud Canal, Orleans Parish, Louisiana	April 21, 2010
8	CAR for IER #8 for the project entitled "Bayou Dupre Control Structure Replacement Project, St. Bernard Parish, Louisiana"	May 28, 2009
9	CAR for IER Lake Pontchartrain and Vicinity Orleans East Bank, Caernarvon Canal, New Orleans, Louisiana (IER #9, LPV Reach 149)	January 25, 2010
10	CAR for IER Lake Pontchartrain and Vicinity Orleans East Bank, Chalmette Loop Levee, New Orleans, Louisiana (IER #10)	May 19, 2009
11	CAR for IER #11, Tier 1 Improved Protection on the IHNC	Feb 26, 2008
11	CAR for IER #11, Tier 2 Borgne for the Improved Protection on the IHNC, Orleans and St. Bernard parishes, Louisiana	October 9, 2008
11	CAR for IER #11 Tier 2 Borgne Supplemental, Orleans and St. Bernard Parishes, Louisiana	November 17, 2010
11	CAR for IER #11, Tier 2 Pontchartrain for the IHNC, Orleans and St. Bernard parishes, Louisiana	March 29, 2010
12	CAR for IER #12 Improved Protection from Harvey to Algiers, Jefferson, Orleans and Plaquemines parishes, Louisiana	February 18, 2009
13	CAR for IER #13 for the Westbank and Vicinity of New Orleans Hurricane Protection Project, East of Algiers Canal, Hero Canal to Oakville Tie-In in Plaquemines Parish, Louisiana	November 24, 2009
14	CAR for IER #14 for the Westwego to Harvey Levee, Jefferson Parish Louisiana.	August 18, 2008
S 14.a	CAR for Supplement IER #14 for the Westwego to Harvey Levee, Jefferson Parish, Louisiana	January 13, 2010
15	CAR for IER #15 for the Lake Cataouatche Levee, Jefferson Parish Louisiana	July 28, 2008
16/S 16.a	CAR for IER #16 and IERS #16, Westbank and Vicinity, Western Tie-in, Jefferson and St. Charles parishes, Louisiana*	August 11, 2010
17	CAR for IER #7 for the Company Canal Floodwall, Jefferson Parish Louisiana	December 22, 2008
18	CAR for IER #18 for the excavation for government-furnished borrow.	November 15, 2010

Table 6-2, continued

IER/IER # ¹	Title of Final USFWS CAR	Final CAR Signatory Date
19	CAR for IER #19, Contractor-furnished Borrow Material Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parish, Louisiana, and Hancock County, Mississippi	November 15, 2010
22	CAR for IER #22 Government-furnished Borrow Material #2 Jefferson and Plaquemines parishes, Louisiana	November 15, 2010
23	CAR for IER #23 Pre-Approved Contractor-furnished Borrow Material #2 St. Bernard, St. Charles, and Plaquemines parishes, Louisiana, and Hancock County, Mississippi	November 15, 2010
25	CAR for IER #25 Government-furnished Borrow Material #3 Jefferson, Orleans, and Plaquemines parishes, Louisiana	November 15, 2010
26	CAR for IER #26 Pre-Approved Contractor-furnished Borrow Material #3 Jefferson, Plaquemines, and St. John the Baptist parishes, Louisiana, and Hancock County, Mississippi	November 15, 2010
27	CAR for IER #27, Proposed Outfall Canal Remediation on the 17 th Street, Orleans Avenue and London Avenue Canals, Jefferson and Orleans parishes, Louisiana	October 1, 2010
28	CAR for IER #28 Government-furnished Borrow Material #4, Jefferson, Plaquemines, and St. Bernard parishes, Louisiana	July 27, 2009
29	CAR for IER #29, Pre-approved Contractor-furnished Borrow Material #4, Orleans, St. Charles, St. John the Baptist, and St. Tammany parishes, Louisiana	September 3, 2009
30	CAR for IER #30 Contractor-furnished Borrow Material #5, St. Bernard, and St. James parishes, Louisiana, and Hancock County, Mississippi	September 23, 2009
31	CAR for IER #31 Contractor-furnished Borrow Material #7, East Baton Rouge, Jefferson, Lafourche, Plaquemines, St. Bernard, and St. Tammany parishes, Louisiana, and Hancock County, Mississippi	October 22, 2010
32	CAR for IER #32 Contractor-furnished Borrow Material #6, Ascension, Plaquemines, and St. Charles parishes, Louisiana	January 20, 2010

* Typically the IER and the IER Supplemental had two separate CARs; however, in the case of the IER #16 and the IERS #16.a a single CAR addressed both documents' proposed actions.

¹ S - Supplemental

The USFWS provided CEMVN a revised draft CAR for the CED on May 17, 2013 (Appendix Q). NMFS provided a comment letter on the draft CAR on November 2, 2012 (Appendix Q). The revised draft CAR for the CED contains specific recommendations for minimizing adverse impacts on the natural environment and for mitigation of impacts on wetlands and BLH. The USFWS' recommendations and the CEMVN responses to the recommendations as they are addressed in the CED are as follows:

Recommendation 1. To the greatest extent possible, situate final flood protection features so that destruction of wetlands and non-wet bottomland hardwoods are avoided or minimized.

CEMVN Response 1: The project will utilize the authorized level of risk reduction footprint and minimize impacts on wetlands.

Recommendation 2. Avoid adverse impacts to bald eagle 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.

CEMVN Response 2: The clearing of forested wetlands would be conducted in the fall or winter, if practicable, to avoid and minimize impacts on nesting migratory birds. If colonial-nesting wading birds are anticipated to nest in forested areas slated for clearing during the nesting season, the USACE would likely employ other measures to avoid impacts on active colonial-nesting wading bird nests, viable eggs in such nests, and nesting young, such as implementation of a colonial-nesting wading bird nesting prevention/abatement plan. Any such plan would first be coordinated with USFWS.

Recommendation 3. If a proposed project feature is changed significantly or is not implemented within one year of the date of our Endangered Species Act consultation letter, we recommend that the Corps reinstate coordination with this office to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their habitat.

CEMVN Response 3: Concur

Recommendation 4. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

CEMVN Response 4: The USACE intends to compensate for unavoidable losses of wetland habitat and non-jurisdictional BLH (BLH-Dry) resulting from HSDRRS construction to the extent practicable. Note that mitigation for BLH-Dry impacts resulting from the use of contractor-furnished borrow sites is the responsibility of the site owners or contractors rather than the USACE.

Recommendation 5. For mitigation areas that would be non-tidal for a brief period (till restoration of tidal connectivity) mitigation for this temporal loss would be required. However, mitigation that would not have tidal connectivity restored for several years should not be a component of any mitigation plan.

CEMVN Response 5: Mitigation for impacts on marsh habitats would typically involve restoration of marsh habitats. The USACE agrees that such mitigation features would likely be non-tidal for a limited period until tidal connectivity is restored, and understands that mitigation for this temporal loss is necessary. Such a temporal loss would be captured in WVA marsh community models. The USACE is presently not contemplating any marsh mitigation projects that would lack tidal connectivity for several years, and agrees that such projects should be avoided. However, USACE-constructed mitigation projects slated as compensation for HSDRRS impacts on jurisdictional BLH habitats, non-jurisdictional BLH habitats, and swamp habitats would not rely on tidal connectivity to achieve the appropriate habitat functions and values. Thus, your recommendation is deemed not applicable to such projects.

Recommendation 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.

- CEMVN Response 6: The USFWS and other resource agencies will be provided an opportunity to review and comment on the proposed HSDRRS construction plans and mitigation plans during the project feasibility study and Pre-Construction Engineering and Design.
- Recommendation 7. The Corps should avoid impacts to public lands, if feasible. If not feasible the Corps should establish and continue coordination with agencies managing public lands that may be impacted by a project feature until construction of that feature is complete and prior to any subsequent maintenance. Points of contacts for the agencies potentially impacted by project features are: Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Neal Lalonde (985) 822-2000, Refuge Manager for the Bayou Sauvage National Wildlife Refuge (NWR), Office of State Parks contact Mr. Brent Evans at 1-888-677-1400, National Park Service (NPS), contact Superintendent Carol Clark, (504) 589-3882 extension 137 (Carol_Clark@nps.gov) or Chief of Resource Management Guy Hughes (504) 589-3882 extension 128, (Guy_Hughes@nps.gov) and for the 404(c) area contact the previously mentioned NPS personnel and Ms. Barbara Keeler (214) 665-6698 with the EPA.
- CEMVN Response 7: Concur
- Recommendation 8. 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.
- CEMVN Response 8: Concur
- Recommendation 9. 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.
- CEMVN Response 9: The non-Federal sponsor is responsible for operation and maintenance of the HSDRRS projects, including the mitigation features. Where mitigation features are located on Federal lands, the appropriate agency and the non-Federal sponsor would need to coordinate management of the mitigation project. Where mitigation projects are to be constructed on lands within a Federal agency's jurisdiction, that agency will be consulted regarding any requirements that will be applicable to those lands.
- Recommendation 10: 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.

CEMVN Response 10: Project Partnership Agreements (PPAs) between the Federal government and the non-Federal sponsor (CPRA in this case) have been executed for the LPV and WBV HSDRRS projects, and these PPAs provide the requisite high level of confidence that the non-Federal sponsor will fulfill its obligations to operate and to maintain the HSDRRS mitigation projects. In the event that the non-Federal sponsor fails to perform, CEMVN has the right to complete, operate, maintain, repair, rehabilitate, or replace any project feature, including mitigation features. However, such an action would not relieve the non-Federal sponsor of its responsibility to meet its obligations and would not preclude the Federal government from pursuing any remedy at law or equity to ensure the non-Federal sponsor's performance.

Recommendation 11. Any proposed change in mitigation features or plans should be coordinated in advance with the Service, NMFS, LDWF, EPA and LDNR.

CEMVN Response 11: Mitigation for the habitat losses caused by the HSDRRS projects would be coordinated through mitigation IERs. Any material changes to the mitigation plan after the IERs would be coordinated in advance.

Recommendation 12. 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.

CEMVN Response 12: The USACE shares your goal of implementing mitigation as quickly as possible. If delays are experienced such that mitigation project implementation takes longer than what was previously estimated, the USACE will work with the resource agencies to determine whether such delays could necessitate extending the current period of analysis associated with the habitat impacts and whether additional temporal loss to the habitats in question would result in a larger mitigation requirement.

Recommendation 13. 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. Additionally, the Service does not support the selection of the Golden Triangle mitigation alternative. However, NMFS believes that implementation of the Golden Triangle mitigation project may afford storm wave reduction benefits to the Surge Barrier and does not object to mitigating impacts in the Golden Triangle. Furthermore, the Service supports the mitigation of on-refuge flood-side bottomland hardwood 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.

CEMVN Response 13: The USFWS's position concerning the Bayou Sauvage mitigation alternative and the Golden Triangle mitigation alternative is noted. The

USFWS's reference to NMFS's position regarding the Golden Triangle mitigation alternative is also noted, although the USACE does not necessarily agree that this alternative would provide any significant wave reduction benefits to the Surge Barrier. Currently, the Bayou Sauvage mitigation alternative for mitigating LPV HSDRRS impacts on brackish marsh habitats is the Tentatively Selected Plan. The USACE will continue to coordinate with USFWS and other resource agencies in developing mitigation plans for LPV HSDDRS impacts to on-refuge flood side BLH impacts.

Recommendation 14. The Service has informally expressed concerns via emails dated May 4, 2011, and June 9, 2011, regarding the mitigation of alternatives along State Highway 45 that were developed to mitigate impacts to NPS lands. The Service recommends that the Corps continue coordinating the development of mitigation plans and address our concerns.

CEMVN Response 14: This comment/recommendation pertains to preliminary mitigation plan concepts for mitigating impacts on swamp and jurisdictional BLH (BLH-Wet) habitats located within the Barataria Preserve Unit of JLNHPP and within the Bayou aux Carpes Clean Water Act Section 404(c) area (the 404c area). The specific preliminary design plans referenced were developed by the Project Delivery Team (PDT) during the Alternatives Evaluation Process (AEP). Certain mitigation features contained in these plans involved restoring swamp and/or BLH-wet habitats in existing man-made open water areas including canals and borrow pits by filling these features and then planting native canopy and mid-story species. The proposed method of fill in certain features involved first placing a layer of sand, then capping this layer with a layer of clay soil to bring the feature to the final desired elevation.

USFWS expressed concerns regarding the proposed approach to filling the mitigation features, noting that staff had observed problems with the survival and growth of trees planted in areas that employed a similar fill scheme. However, the proposed approach to fill placement has been successful in other projects involving restoration of forested habitats (e.g., mine reclamation projects, wetland mitigation projects in other regions). Other experts (NRCS, ERDC) thus far consulted on the proposed fill scheme have not voiced any concerns with this design concept, commenting that the final layer of clayey soil need only be 1.5 to 3.5 feet thick.

CEMVN is still in the process of developing more specific mitigation plans for WBV HSDRRS impacts on Park/404c habitats. This process includes examining various approaches to filling open water habitats slated for swamp and BLH-Wet restoration. CEMVN will continue to coordinate with USFWS, other resource agencies, and the PDT in the development of these plans.

Recommendation 15. The Corps in cooperation with the natural resource agencies is still evaluating alternative enhancement measures for the EPA Bayou aux Carpes 404(c) designated wetlands. Enhancement measures, which would ensure the integrity of the 404(c) area is maintained, are a condition of the 404(c) modification. The service encourages the Corps to select and implement the preferred enhancement alternative(s).

CEMVN Response 15: In 2009, the “1985 Clean Water Act Section 404(c) Final Determination for Bayou aux Carpes” was modified to allow construction of certain portions of the WBV HSDRRS that would impact habitats in the 404c area. The modification called for mitigation of direct impacts on habitats (e.g. impacts within the “footprint” of HSDRRS features constructed in the 404c area). It also called for the evaluation of various additional features (e.g. features/actions in addition to mitigation features provided for the direct impacts) that might provide environmentally beneficial hydrologic and wetland effects to the 404c area. These additional features/activities were referred to as “enhancement” features and as “augmentation” features.

As stated in the 2009 modification, the USACE agreed to fund and implement the enhancement/augmentation features “...if the results of ongoing investigations indicate that they will contribute environmental benefits.” The modification stated that “...project augmentation measures will be considered by the interagency team to enhance wetland functions and values of the site and provide added compensation for any unavoidable impacts.”

The 2009 modification did not specifically identify potential enhancement/augmentation features or activities; however, IER 12 did include a listing of potential enhancement/augmentation features. Potential enhancement/augmentation features and activities are still being developed and evaluated by the USACE and the Interagency Team. This group has not yet formulated a final array of alternatives and has not yet completed an evaluation of such alternatives for things like potential benefits and impacts, effectiveness, costs, and feasibility; thus, there presently are no final “preferred enhancement alternatives”. The USACE will continue developing and evaluating potential alternatives in coordination with the Interagency Team.

Recommendation 16. The Service recommends that the Corps work with the natural resource agencies to incorporate proposed modifications and finalize the “GUIDELINES – WET BOTTOMLAND HARDWOOD HABITAT ENHANCEMENT, SWAMP HABITAT RESTORATION, AND SWAMP HABITAT ENHANCEMENT” and the untitled document for marsh mitigation.

CEMVN Response 16: The guidelines cited by USFWS, which actually now include guidelines for fresh marsh and intermediate marsh mitigation, were originally developed as very generalized guidelines for use in developing and evaluating potential LPV and WBV HSDRRS mitigation alternatives involving USACE-constructed projects. The main objective for these guidelines was to help ensure consistency between LPV and WBV mitigation alternatives as regards things such as future with project WVA models, mitigation design concepts, and estimated mitigation costs (i.e., construction, implementation, maintenance, monitoring and reporting, etc.).

Programmatic IERs and Tiered IERs are being prepared for the LPV HSDRRS mitigation project and for the WBV HSDRRS mitigation project. In cases involving USACE-constructed mitigation projects, these documents (Programmatic IERs or Tiered IERs) will contain

project-specific information pertaining to the proposed mitigation work plan, mitigation success criteria, mitigation monitoring and reporting, mitigation management/maintenance, and, if necessary, proposed adaptive management plan for each Tentatively Selected Plan. In cases where the Tentatively Selected Plan is to purchase credits from a mitigation bank, the Programmatic IERs or Tiered IERs will also provide similar project-specific information for the highest ranked USACE-constructed mitigation alternative that would be used if it were ultimately determined that purchase of mitigation bank credits is no longer the best alternative. The project-specific mitigation information developed will supersede the cited general guidelines. The USACE will continue to coordinate with USFWS, other resource agencies, and other members of the PDT in preparing components of the project-specific mitigation programs.

Recommendation 17. The Service recommends that the Corps maintain full responsibility for any mitigation project for a minimum of 4-years post planting. The Corps should maintain full responsibility for all marsh mitigation projects until the projects are found to be fully compliant with success and performance requirements. Those requirements should be developed in cooperation with the resource agencies and included in the mitigation IERs.

CEMVN Response 17: Presently, the USACE intends to issue a Notice of Construction Completion for authorized USACE-constructed mitigation projects to the non-Federal sponsor upon the successful completion of mitigation construction activities (e.g. project would shift from the “construction” phase to the “OMRR&R” phase at this point). However, the USACE would retain the primary responsibility for the completion of certain mitigation activities necessary to meet the project’s initial success criteria. These activities would vary depending on the specifics of the mitigation plan and its associated success criteria. Note that while the USACE would be responsible for completion of mitigation construction and certain activities after the Notice of Construction Completion, all these activities would be subject to standard cost-sharing provisions and the availability of funds.

After initial success criteria are reached, the USACE will continue to support the non-Federal sponsor's operation and maintenance of the mitigation project features as follows; if the project is not achieving its performance milestones, USACE will consult with the non-Federal sponsor and other agencies to consider operational changes to the mitigation plan and/or adaptive management measures to be implemented in accordance with relevant guidance, cost-sharing requirements and subject to availability of funds.

Mitigation success criteria for all proposed USACE-constructed mitigation projects have been and will continue to be developed in coordination with the resource agencies. Those mitigation IERs seeking authorization to implement USACE-constructed mitigation projects will contain detailed mitigation plans, including applicable mitigation success criteria and monitoring programs to gage the success/performance of such projects.

Recommendation 18. The Service recommends that the continued coordination of the development of Water Control Plans until all plans are finalized and for any future changes to the plans.

CEMVN Response 18: Concur

Recommendation 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.

CEMVN Response 19: At this time, mitigation planning is ongoing. For USACE-constructed mitigation features, the mitigation plan will contain a contingency plan for taking corrective actions in cases in which monitoring demonstrates that mitigation measures are not achieving ecological success. The USACE will continue to coordinate with USFWS, other resource agencies, and other members of the PDT in preparing components of the project-specific mitigation programs, including the preparation of AMPs and guidance for addressing unforeseen threats to mitigation success.

Recommendation 20: The Service recommends that impacts associated with contractor-provided borrow sources and status of mitigation implementation be provided to the Service.

CEMVN Response 20: BLH was impacted at the Willow Bend, Eastover Phase 2, and Stumpf Phase 1 Contractor furnished borrow pits. The BLH was impacted during single events associated with a specific levee construction contracts and mitigation credits were purchased for the impacts that resulted due to the individual contracts. The impacts on BLH were a onetime event and future use of the pits did not further impact additional BLH. Evidence of mitigation credits purchased for impacts at Willow Bend, Eastover Phase 2 and Stumpf Phase 1 were provided to the USFWS via email on June 15, 2012. Table 6-3 provides information regarding BLH impacts and mitigation credits purchased.

Table 6-3. Bottomland Hardwood Mitigation for Contractor-Furnished Borrow*

Levee Reach	Contractor	Borrow Area	Acres	AAHUs	Mitigation Status
WBV-14.c.2	Phylway	Willow Bend "Mine Area 2"	8.82	4.87	Credits purchased 7/28/2010 (Paradis)
WBV-14.e.2	Phylway	Willow Bend "Mine Area 2 Expansion"	1.97	1.09	Credits purchased 7/28/2010 (Paradis)
WBV-15.a.2	Phylway	Willow Bend "Mine Area 2"	1.97	1.09	Credits purchased 5/31/2011 (Paradis)
WBV-09.a	Kiewit	Willow Bend "Mine Area 2"	1.97	1.09	Credits purchased 5/31/2011 (Paradis)
WBV-12	Gulf Intracoastal Constructors	Willow Bend "Mine Area 2"	1.97	1.09	Credits purchased 5/31/2011 (Paradis)
Supply Contract	Chapel Hill	Eastover Phase 2 "Extra Acreage"	1.56	0.33	Credits purchased 5/31/2011 (Paradis)
Supply Contract	Chapel Hill	Eastover Phase 2 "Access Roads"	2.3	0.48	Credits purchased 7/22/2010 (Paradis)

Table 6-3, continued

Levee Reach	Contractor	Borrow Area	Acres	AAHUs	Mitigation Status
LPV 109	Archer Western	Eastover Phase 2 "Acreage along Paris Road"	21.94	4.57	Access road not constructed. No impact on BLH.
Supply Contract	Chapel Hill	Stumpf Phase 1 (Stockpile)	22.41	6.19	Access road not constructed. No impact on BLH.
WBV-09.a	Kiewit	Idlewild Stage 2	80.56	54.63	USACE purchased mitigation credits from Paradis, covered in Supplemental IER 25a. Idlewild Stage 2 borrow area has never been used and BLH has not been impacted. USACE is in on-going discussions with the landowner regarding mitigation requirements.
WBV-MRL.-1.1	Cycle Construction	Idlewild Stage 2	80.56	80.56	

*updated on December 5, 2012

6.3 FINAL COMPREHENSIVE ENVIRONMENTAL DOCUMENT PHASE I

This Final Comprehensive Environmental Document (CED) Phase I titled, "Comprehensive Environmental Document Greater New Orleans (GNO) Area Hurricane Storm Damage Risk Reduction System (HSDRRS)", prepared by the CEMVN, is available for your review. Future supplement(s) to the Phase I CED are anticipated, and the District Commander will issue a Decision Record following the completion of all supplement(s) to the Phase I CED.

The draft CED phase I was released for 60 day public review on February 5, 2013. Stakeholders had until April 8, 2013, to comment on the CED. Comments were received from 12 stakeholders, four Federal agencies, two State agencies, and two local agencies. Public meetings pertaining specifically to the CED occurred on March 27, 28, and 29, 2007, April 3, 4, 5, 10, 11, and 12, 2007, September 2, 2009, and March 14 and 26, 2013.

Below is a list of the comments received, and all comments and CEMVN responses are located in Appendix C.

1. Public Comments

- a. Dennis Strecker, letter dated February 7, 2013
- b. Thomas Thompson, letter dated February 7, 2013
- c. John Koferl, email dated February 22, 2013
- d. Edward Chauppetta, letter dated March 19, 2013
- e. Roy Arrigo, email dated March 20, 2013
- f. Ray Garfalo, State Representative District 103, oral comment at public meeting on March 26, 2013
- g. Bethany Garfield, oral comment at public meeting on March 26, 2013
- h. Rudy Newbeck, oral comment at public meeting on March 26, 2013
- i. Margaret Longstreet, oral comment at public meeting on March 26, 2013

- j. RESTORE, letter dated March 30, 2013
- k. Louisiana Audubon Council, letter dated April 8, 2013
- l. Gulf Restoration Network, letter dated April 8, 2013

2. Agency Comments

- a. Louisiana Department of Environmental Quality, email dated March 1, 2013
- b. U.S. Environmental Protection Agency, letter dated March 19, 2013
- c. City of Waveland, oral comment at public meeting on March 26, 2013
- d. Jason Smith, Jefferson Parish Department of Environmental Affairs, voicemail message dated March 27, 2013
- e. NMFS, letter dated April 2, 2013
- f. USFWS, letter dated April 5, 2013
- g. Louisiana Coastal Protection and Restoration Authority, email dated April 5, 2013
- h. National Park Service, letter dated April 15, 2013

The 30-day public review period for this Final CED Phase I will begin on May 22, 2013. Please contact Mrs. Sandra Stiles; U.S. Army Corps of Engineers; CEMVN-PDN; P.O. Box 60267; New Orleans, Louisiana 70160-0267 to request a hard copy. Requests also can be made by calling (504) 862-1583, by e-mail to mvnenvironmental@usace.army.mil, or by fax (504) 862-2088.

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SECTION 7.0
COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS



7.0 COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

In addition to the agency coordination and consultation outlined in section 6.0, the USACE must comply with many environmental laws and regulations. Although the HSDRRS is a system-wide risk reduction project, the performance of each IER was allowed to stand alone; therefore, the compliance for an IER's particular Proposed Action was required prior to the Decision Record being signed by the District Commander.

As such, construction of an IER Proposed Action did not commence until the Proposed Action achieved environmental compliance with all applicable laws and regulations. In addition, all other applicable laws and regulations were followed for all the HSDRRS Proposed Actions. A list of the relevant laws and regulations, including the agency tasked with the jurisdiction for each and the respective permit, license, compliance, or other review, is detailed in table 7-1. Appendix R indicates the coordination/consultation and the dates on which concurrence was obtained to satisfy the relevant laws and regulations for each specific IER or IER Supplemental.

**Table 7-1. Relevant Laws and Regulations Providing Guidance
in the Development of the HSDRRS**

Relevant Laws and Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
<i>Sound/Noise</i>			
Noise Control Act of 1972 (42 USC 4901 <i>et seq.</i>), as amended by Quiet Communities of 1978 (P L 95- 609)	USEPA	Compliance with surface carrier noise emissions	Construction and operations
<i>Air</i>			
Clean Air Act and amendments of 1990 (42 USC 7401(q)) 40 CFR 50, 52, 93.153(b)	USEPA	Compliance with NAAQS and emission limits and/or reduction measures	Construction and operations
<i>Water</i>			
Clean Water Act of 1977 (33 USC 1342) 40 CFR 122	USEPA	Section 402(b) National Pollutant Discharge Elimination System General Permit for Stormwater Discharges for Construction Activities	Construction sites with greater than 1 acre of land disturbed
EO 11988 (Floodplain Management), as amended by EO 12608	Water Resources Council, FEMA, and CEQ	Compliance	Construction in or modification of floodplains
EO 11990 (Protection of Wetlands), as amended by EO 12608	USACE and USFWS	Compliance	Construction in or modification of wetlands
Clean Water Act of 1977 (33 USC 1341 <i>et seq.</i>) 40 CFR 121	LDEQ	Section 401 Water Quality Certification	Potential discharge into waters of the state (including wetlands and washes)
Clean Water Act of 1977 (33 USC 1344) 40 CFR 230	USACE	Section 404(b)(1)	Discharge of dredge or fill material to a watercourse
Clean Water Act of 1977 (33 USC 1344) 40 CFR 230	USEPA	Section 404(c)	USEPA may exercise a veto over the specification by the USACE or by a state of a site for the discharge of dredged or fill material
Coastal Zone Management Act of 1972 (16 USC 1456(c)) Section 307	Administered by LDNR	Consistency Determination	Consistency with the Louisiana Coastal Management Program
<i>Soils</i>			
Resource Conservation and Recovery Act of 1976 (42 USC 6901(k)), as amended by Hazardous and Solid Waste Amendments of 1984 (P L 98-616; 98 Statute 3221)	USEPA	Proper management, and in some cases, permit for remediation	Current operation involving hazardous waste and/or remediation of contamination site

Table 7-1, continued

Relevant Laws and Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
Comprehensive, Environmental Response, Compensation, Liability Act of 1980 (42 USC 9601), as amended by Emergency Planning and Community Right-To-Know-Act of 1986 (42 USC 11001 <i>et seq.</i>)	USEPA	Development of emergency response plans, notification, and cleanup	Release or threatened release of a hazardous substance
Farmland Protection Policy Act of 1981 (7 USC 4201 <i>et seq.</i>) 7 CFR 657-658	NRCS	NRCS determination via Form AD-1006	Prime and unique farmlands
Soil Conservation Act (16 USC 590(a) <i>et seq.</i>)	NRCS	Compliance	Soil conservation of Federal lands
<i>Natural Resources</i>			
Endangered Species Act of 1973, as amended (16 USC 1531) Sections 7 and 9 50 CFR 17.11-17.12	USFWS, NMFS	Compliance by lead agency and/or consultation to assess impacts and, if necessary, develop mitigation measures	Identification of threatened and endangered species and their critical habitats
Migratory Bird Treaty Act of 1918 (16 USC 703) 50 CFR Chapter 1	USFWS	Compliance by lead agency and/or consultation to assess impacts and, if necessary, develop mitigation measures	Protection of migratory birds
Bald and Golden Eagle Act of 1940, as amended (16 USC 688(d)) 50 CFR 22.3	USFWS	Compliance by lead agency and/or consultation to assess impacts and, if necessary, obtain permit	Protection of bald and golden eagles
Fish and Wildlife Conservation Act (16 USC 2901)	USFWS, NMFS	Compliance	Conserve and promote conservation of non-game fish and wildlife and their habitats
Marine Mammal Protection Act of 1972 (16 USC 1361)	NMFS	Compliance by lead agency and/or consultation to assess impacts and, if necessary, develop mitigation measures	Protection of marine mammals
EO 13112 (Invasive Species)	USACE and Port of New Orleans	Compliance	Requires agencies to restrict the introduction of exotic organisms into natural ecosystems
<i>Health and Safety</i>			
Occupational Safety and Health Act of 1970 (29 USC 651) 29 CFR 1975	OSHA	Compliance with guidelines, including Material Safety Data Sheets	Health and safety standards

Table 7-1, continued

Relevant Laws and Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
<i>Cultural/Archaeological</i>			
NHPA (16 USC 470 <i>et seq.</i>) 36 CFR 800 Army Regulation 200-4, Cultural Resources Management Presidential Memorandum regarding Government to Government Relations (April 29, 1994) EO 13007 (Indian Sacred Sites)	USACE, SHPO, ACHP, and Tribes	Section 106 Consultation	Assessment of cultural resources and avoidance of disturbance of historic properties
Native American Graves Protection and Repatriation Act 43 CFR 10	USACE, SHPO, ACHP, and Tribes	Compliance	Protection of Native American sites, graves, and sacred objects
Archaeological Resources Protection Act of 1979 (16 USC 470(a)(a)-470(ii)) 43 CFR 7	Affected land- managing agency	Permits to survey and excavate/ remove archaeological resources on Federal lands; Native American tribes with interests in resources must be consulted prior to issue of permits	Investigation and excavation of cultural resources on Federal lands such as JLNHPP and Bayou Sauvage NWR.
<i>Socioeconomic</i>			
EO 13045 (Protection of Children from Environmental Health Risks and Safety Risks)	USEPA	Compliance	Identify and assess environmental health risks and safety risks that may disproportionately affect children
EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)	USEPA	Compliance	Identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations

SECTION 8.0
FUTURE OPERATION AND MAINTENANCE REQUIREMENTS



8.0 FUTURE OPERATION AND MAINTENANCE REQUIREMENTS

8.1 OVERVIEW

Local residents and industry depend upon the proper maintenance and operation of the floodwalls, floodgates, and earthen levees, as well as all the other HSDRRS components for flood risk reduction. Neglect or failure to operate the system correctly could subject residents to flood and health hazards related to failure or overtopping of the system. Although the CEMVN designed and constructed the HSDRRS, the non-Federal sponsors will operate, maintain, repair, replace, and rehabilitate the HSDRRS (ER 1110-2-401). USACE engineering regulations and policy documents critical to the development of the HSDRRS OMRR&R manuals and Water Management Plans include:

- *USACE Process for the National Flood Insurance Program (NFIP) Levee System Evaluation* (EC 1110-2-6067)
- *Engineering and Design – Water Control Management* (ER 1110-2-240)
- *Engineering and Design – Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors* (ER 1110-2-401)
- *Local Cooperation* (ER 1150-2-301)
- *Emergency Employment of Army and Other Resources – Civil Emergency Management Program* (ER 500-1-1, Engineer Pamphlet 500-1-1)
- *Engineering and Design - Design and Construction of Levees* (Engineer Manual [EM] 1110-2-1913)
- *Engineering and Design - Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams* (EM 1110-2-301)
- *Engineering and Design - Structural Design of Closure Structures for Local Flood Protection Projects* (EM 1110-2-2705)
- *Engineering and Design - Environmental Engineering for Flood Control Channels* (EM 1110-2-1205)

The non-Federal sponsors adherence to the OMRR&R requirements for the HSDRRS is critical to ensure the continued performance of the system; it is also required as part of the NFIP Levee System Evaluation of the HSDRRS.

The non-Federal sponsors must operate and maintain the HSDRRS in accordance with the operations and maintenance manuals developed in accordance with ER 1110-2-401, ER 1110-2-240, and other applicable laws, regulations, and policies. In order for the non-Federal sponsors to operate and maintain the system correctly, the operating personnel must receive adequate training in the proper operation and maintenance of specific portions of the HSDRRS. The CEMVN is developing a HSDRRS Project System Management Plan. The plan follows a tiered approach with regional and structure-specific plans. In addition, Water Control Plans also will be developed for applicable water control structures. There are four levels of the OMRR&R manuals:

- Level I: HSDRRS Project System Management Plan – overall system (HSDRRS) plan guidance;
- Level II: Regional Area – guidance specific to a regional area (HSDRRS LPV and WBV);
- Level III: Construction Contract – specific guidance per reach or segment of the HSDRRS (e.g. Western Closure Complex WBV-90); and
- Level IV: Functional Portion of Construction Contract – guidance further broken down by structure or the HSDRRS feature (e.g. Water Control manuals).

The OMRR&R plans will be separated into three different volumes. Volume 1 will include the required information from ER 1110-2-401. Volume 2 will include the *Levee Owner's Manual for Non-Federal Flood Control Works*, as well as a supplement to that document to include local issues not covered. Volume 3 will consist of pertinent information for each specific HSDRRS construction contract.

In 2010, the State of Louisiana through the Coastal Protection and Restoration Authority of Louisiana requested that the USACE prepare and submit to FEMA the Levee System Evaluation Report for the entire HSDRRS. USACE is following the procedures outlined in EC 1110-2-6067 to prepare the report.

The USACE will undertake the Levee System Evaluation as detailed in EC 1110-2-6067. This EC is consistent with and founded on the principles of 44 CFR 65.10 (FEMA's requirements for mapping flood hazard and risk areas behind levees). The use of the phrase "NFIP Levee System Evaluation" rather than the phrase "Levee Certification" emphasizes the true purpose of evaluating the complete HSDRRS status with regard to requirements of both 44 CFR 65.10 and relevant USACE guidelines. This phrase better supports the FEMA definition of "certification" as defined in 44 CFR 65.2(b), which focuses on certification of analysis and data.

The OMRR&R manuals and water control plans will provide the non-Federal sponsor with the necessary tools and information to maintain the system within the Federal standards. Compliance with OMRR&R requirements is necessary to maintain recognition under the NFIP as administered by FEMA.

An NFIP Levee System Evaluation is a technical finding in which there is a reasonable assurance that the levee system will exclude the 1 percent annual chance exceedance flood (or base flood) from the leveed area. The local community is responsible for providing the documentation to fulfill the requirements of 44 CFR 65.10. As part of the NFIP Levee System Evaluation, the USACE will examine and report on elements of residual flood risk and public safety. In the cases of a positive USACE NFIP Levee System Evaluation finding, the maximum length of its validity is 10 years. At the end of that period in which the positive finding is valid, the evaluation will be reviewed for continued validity. However, the finding may be reviewed any time before the period of validity ends. This guidance does not change FEMA's process for mapping or other requirements for the NFIP.

8.2 THE HSDRRS PROJECT SYSTEM MANAGEMENT PLAN

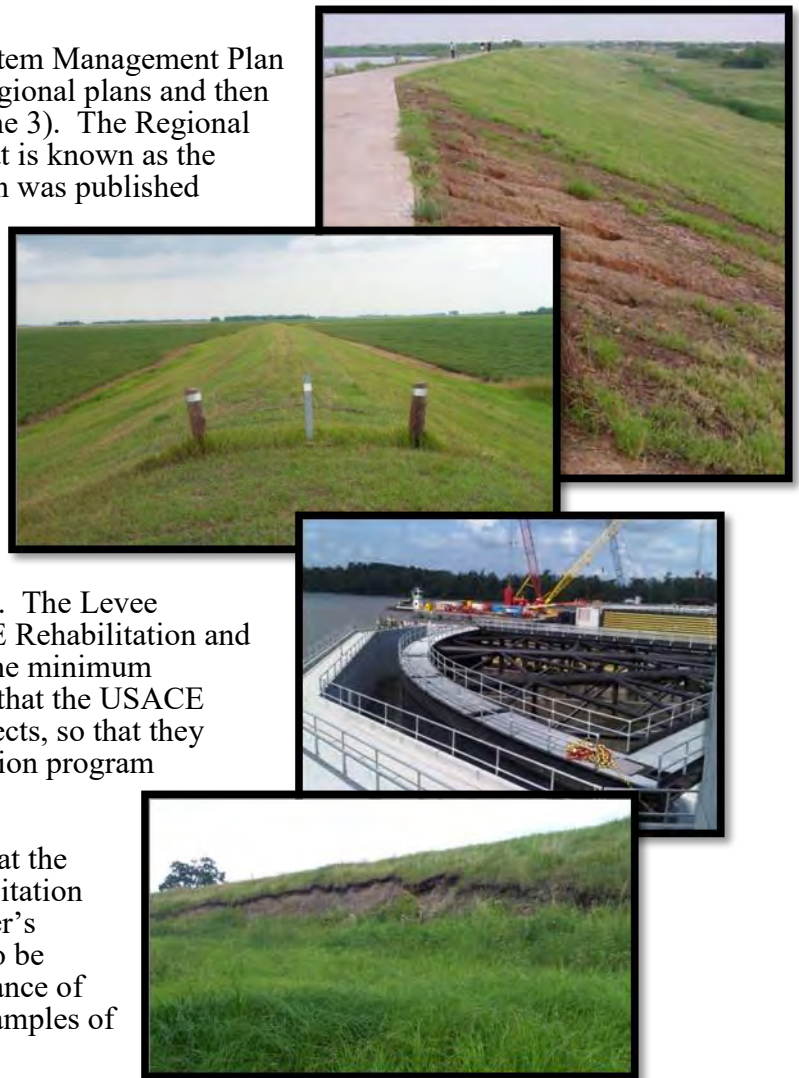
On May 25, 2006, the State of Louisiana empowered the CPRA to carry out all functions necessary to serve as the single state entity responsible to act as the non-Federal sponsor for construction, operation, and maintenance of all hurricane, storm damage reduction, and flood damage reduction projects in the Greater New Orleans Metropolitan and Southeast Louisiana areas. In addition, CPRA entered into several project partnering agreements with the Southeast Louisiana Flood Protection Authority West (West Jefferson and Algiers Levee Districts) and East (East Jefferson, Orleans, and Lake Borgne Basin Levee Districts). CPRA has also entered into direct project partnering agreements with the Pontchartrain Levee District and Plaquemines and St. Charles parishes.

The HSDRRS Project System Management Plan will:

- provide a programmatic plan for long-term management of the HSDRRS, and
- respond to the Interagency Performance Evaluation Task Force or IPET comments regarding System Management.

As noted above, the HSDRRS Project System Management Plan is a tiered plan that is broken down into regional plans and then structure- or feature-specific plans (Volume 3). The Regional Area OMRR&R Manual incorporates what is known as the Levee Owner's Manual (Volume 2), which was published in response to and directed by WRDA of 1996 (USACE 2006a) (P L 104-303). Although called the Levee Owner's Manual, this document was actually written to help local, state, or tribal governments operate and maintain all flood risk reduction works, not just levees. Besides operations and maintenance, the manual also helps these non-Federal government entities plan and prepare for high water, and provides steps to take during emergencies that will help reduce the threat of flooding. The Levee Owner's Manual also explains the USACE Rehabilitation and Inspection Program and further explains the minimum standards for operations and maintenance that the USACE requires of non-Federal flood control projects, so that they may be eligible for the USACE rehabilitation program after a flood (USACE 2006a).

In addition to the baseline requirements that the USACE sets for inclusion into the Rehabilitation and Inspection Program, the "Levee Owner's Manual" provides a listing of conditions to be addressed associated with proper maintenance of flood control works (USACE 2006a). Examples of these conditions (photograph 8-1) include:



Photograph 8-1. Various earthen levee conditions and sector gate.

- Erosion
- Encroachment
- Vegetation (maintenance and control)
- Ruts and depressions
- Underseepage control berms
- Excavations
- Utilities
- Underseepage relief wells/toe drainage
- Seepage
- Closure structures
- Concrete surfaces
- Tilting, sliding and settlement
- Vegetation (floodwall-specific)
- Pump stations

The Regional Area OMRR&R Manual would contain information concerning general background information; authorization and location of the project; construction history and pertinent project information; project performance and cooperation agreements; operations, including emergency operation; maintenance, inspection, and surveillance; repair, replacement, and rehabilitation; and a final section discussing notification of distress (ER 1110-2-401).

8.3 WATER CONTROL STRUCTURE MASTER PLANS

Also included in the HSDRRS Project System Management Plan are the Master Plans for water control structures within the HSDRRS. There are four types of water control structures (as shown in table 8-1), and the size and complexity of the structure dictate the documents that would be provided to the non-Federal sponsor. Figure 8-1 illustrates where the HSDRRS water control structures are located.

Table 8-1. Water Control Structures Types

Water Control Type	Project Size and Complexity	Examples
Type I	Small water projects operated without interaction with district office	Culverts, floodwalls, dry floodgates
Type II	Small projects with simple, infrequent closing - Limited interaction with district office	Small sector gate on small canal
Type III	Moderate complexity and damage potential - real-time water management by district office	Major lock and dam
Type IV	Major projects with complex operations and/or damage potential	Reservoirs, floodways, major diversions

Source: DIVR 1110-2-240



Figure 8-1: Water Control Structures

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Based on the water control type, there are five different water control documents that may apply to a specific type of control structure, including:

- Standing Instruction for the Project Manager of Water Control – provides data collection and reporting procedures and instructions for water regulation in normal and emergency conditions and in the event of a communication outage.
- Water Control Plan – provides information such as the objective of the feature, the roles of the regulating office and the on-site manager, hydrometeorology and water quality, and normal and emergency conditions, and includes Standing Instructions.
- Water Control Manual – provides detailed information to facilitate use of instructions, plates, diagrams, etc., for event assessment and decision making, and includes a Water Control Plan.
- Master Water Control Plan – provides additional information for coordinated operation of several simple structures, and includes Standing Instructions.
- Master Water Control Manual – provides additional information for coordinated operation of several complex structures, and detailed information to assist decision making, and includes a Water Control Plan (ER 1110-2-240).

A Master Water Control Manual provides detailed discussions on the following topics for a particular water control structure:

- a) Basin climate and hydrometeorology
- b) Hydrometeorologic data collection network
- c) Hydrologic forecasting
- d) Overall system plan to achieve system objectives
- e) Management of water control activities

The USACE will sponsor public involvement activities, as appropriate, to apprise the general public of the Water Control Plans (ER 1110-2-240).

As an example of Water Control Plan documents, the Harvey Canal Sector Gate, shown in photograph 8-2, is located between the Harvey-Westwego and Algiers Gretna sub-basins. This sector gate is considered to be a Type II water control structure and is part of the WCC's Water Control System (figure 8-2). The Standing Instructions for the Harvey Canal Sector Gate are an appendix to the Master Water Control Manual for the WCC system (which also includes the Water Control Manual for the WCC, which is a Type IV structure). In addition, the Harvey Canal Sector Gate also has an OMRR&R Manual. The West Jefferson Levee District will have the partnering agreement with CPRA to operate and maintain this sector gate.



Photograph 8-2. Harvey Canal Sector Gate.

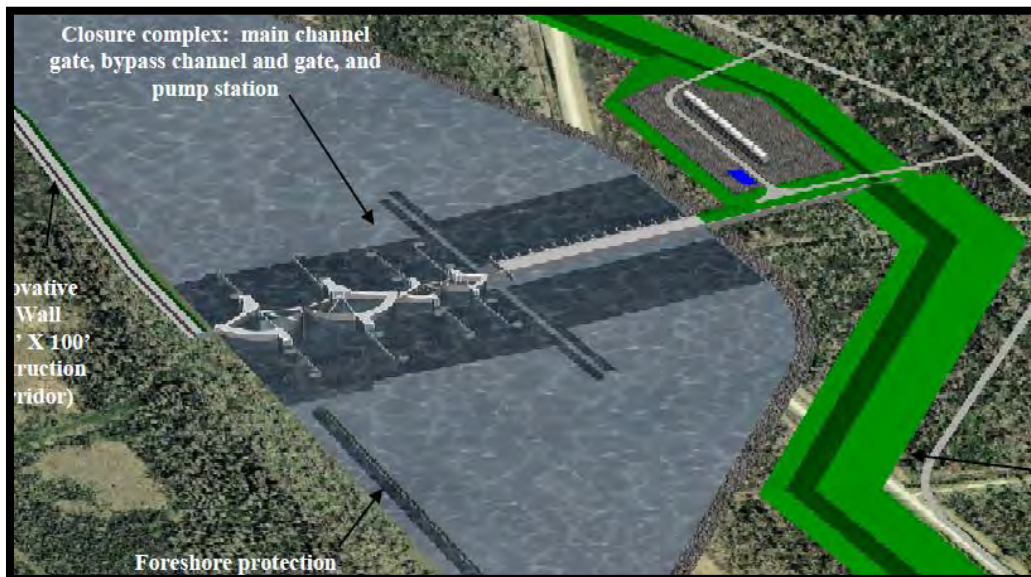


Figure 8-2. Gulf Intracoastal Waterway West Closure Complex

In general, the scope and complexity of the hydrologic forecasting and the overall system plan required to achieve the system objectives determines the necessity of a Master Water Control Manual.

All structures within the HSDRRS system that need water control plans have been identified, and CEMVN is currently formulating the necessary plans, although to date, plans for the HSDRRS water control structures have not been completed.

8.4 ROUTINE INSPECTIONS BY NON-FEDERAL SPONSORS

8.4.1 Non-Federal Sponsor Inspections

Non-Federal sponsors will operate, maintain, repair, replace, and rehabilitate the HSDRRS. The non-Federal sponsors are also responsible for annual inspections, ongoing maintenance, and flood response activities. An Inspection Program should be in place for all the HSDRRS components to ensure that the HSDRRS features provide the risk reduction for which they were designed. This annual inspection program can use the Levee Owner's Manual and the USACE Inspection Guide as templates or guides for these yearly inspections. This type of inspection does not equate to a levee certification or NFIP Levee System Evaluation.

8.4.2 Federal Inspections

As part of the ongoing requirement to ensure compliance of the HSDRRS projects transferred to non-Federal sponsors, the USACE conducts inspections to ensure that the technical obligations outlined in the regulations and specified in the OMRR&R and the Water Control Manuals are being met. This type of inspection does not equate to a levee certification or NFIP Levee System Evaluation. In addition, the USACE will review the required semi-annual and annual reports provided to the USACE by the non-Federal sponsor.

8.5 STORM PREPAREDNESS AND RELATED HIGH WATER EVENT ACTIVITIES

8.5.1 Storm Preparedness Activities

The non-Federal sponsors are responsible for project maintenance and storm surge activities during hurricane or tropical storm events. There are numerous basic preparedness activities that non-Federal sponsors can engage in to ensure they are prepared to fight a storm event and subsequent storm surge. Specifically, sponsors are responsible for the following:

- establishing written storm plans and keeping them up to date, including organizational chart, maps and lists of flood risk reduction features that highlight areas of concern for each feature, lists of closure features indicating signal for closure (i.e., river or canal water levels), storm response plans, short-term planning, and continued plan management
- conducting various training, such as for the physical operation of flood control features, the notification of emergency personnel, testing communication systems, mobilization of monitoring teams, basic storm fight techniques, coordination and control (internal and external), and dissemination of information to the public
- stockpiling needed materials in order to meet storm surge high water response needs, such as sandbags, plastic sheeting, shovels/sandbag filling machines, emergency lighting, riprap, pumps, and borrow material
- implementing other flood risk reduction preparations, such as a plan to have parish, state, and local entities aid in times of high water events

8.5.2 Pre-Storm Activities

Hurricane and tropical storm response plans detail how the non-Federal sponsor will respond to a storm or hurricane event before, during, and after the storm surge. Generally these plans, like those in riverine flood fight techniques, can be placed into two phases:

- Phase I includes preliminary response activities. These activities should be completed prior to a tropical storm or hurricane reaching the necessary track and category ranking triggers. Phase I activities would generally include the following:

- Public sponsor duties, such as alerting personnel and review of emergency plans, identifying potential problem areas, coordinating efforts and alerting landowners if gates or other features are on private land, alerting the general community and updating local/state emergency operations centers (EOC), documenting the situation and sending situation reports to the local EOCs or the USACE, if needed
- Initial inspections of levee sections, determining the conditions (e.g., repairs, trash accumulation), inspecting transportation access, material supplies, communications methods, and drainage structure access (available during storm surge, etc.)
- Short-term general maintenance activities should be performed after all initial inspections are complete, if time allows, prior to storm landfall. However, these maintenance activities should not be a substitute for normal maintenance and should not wait until high water events. Such maintenance may consist of flap gates, sluice gates, or other drainage structure repair. If these repairs cannot be made, then plugging or blocking open these structures, depending on their stated purpose, by any means practical, would be required, and may include the use of timber, metal plates, sandbags, etc. Levee sections or profiles should be compared to “as built” record drawings. Filling of any holes, gullies, or washes may be required, and levee settlement repair is required for any depressions below levee grade.
- Other Phase I activities may include such things as determining serviceability of storm-fighting equipment, closure of the levees to the public, and removal of any livestock.
- Phase II activities would occur after Phase I has been implemented, when the tropical storm or hurricane event has reached certain specific thresholds. Previous storm surge high water history would determine if an area requires a more rapid response.
 - Continuing activities are maintained by the non-Federal sponsor and may include ensuring that competent operators are on-duty even when the station is automated and monitoring and removing debris and trash around structures, as needed
 - Volunteer assistance may be necessary, and if so, the following steps may need to be followed: identifying primary and alternate assembly areas, arranging for transportation, shelter, and food for volunteers, involving media in any volunteer notification, maintaining sign-in rosters to ensure that volunteers are accounted for, identifying staging areas, establishing emergency communications with a manned 24-hour operating EOC, establishing traffic and work flow patterns, and ensuring that a trained individual is supervising all sandbag placement

In addition to ensuring that most of the Phase I and II activities are complied with, the non-Federal sponsor must also be ready for a full evacuation of the area affected by the tropical storm or hurricane event. The predetermined plan for evacuation with predetermined meeting locations should be followed to ensure the safety of all personnel and volunteers.

8.6 RETURNING TO PRE-STORM CONDITIONS

After the tropical storm or hurricane has ended and the conditions and water levels have returned to normal, the area needs to be returned to the pre-storm condition. Several general steps are required, but in general, they are the reverse of the steps taken for storm preparedness and storm surge event activities. The following are some of the procedures that should be followed to return the area to its pre-storm status:

- Reopen any sluice gates or closure structures, and store any necessary components
- All temporary risk reduction measures should be removed and disposed of properly (sand bags, etc.)
- Inventory storm-fighting equipment and repair or replace any damaged equipment
- Salvage any materials or supplies in good condition
- Return all borrowed equipment and identify if any remaining material can be used within the community
- Inspect entire flood control feature and note locations and extent of any damage
- Coordinate potential rehabilitation with the USACE
- Meet with key personnel and other stakeholders for an event debrief and discuss lessons learned
- Revise local emergency plans to reflect lessons learned and document procedural changes
- Document the event by utilizing maps showing areas of stress so repairs of these areas are placed at high priorities and for use as a guide during the next storm as areas of concern
- For future planning, record all high water marks, as well as any storm surge data gathered during the event
- Make any repairs to flood control structures as soon as possible prior to the next potential storm event
- Initiate actions to provide more permanent flood risk reduction for areas where the system relied heavily on temporary measures

8.7 OTHER NON-FEDERAL SPONSOR RESPONSIBILITIES

Accurate record keeping of all repairs to the flood control systems by the non-Federal sponsor is important and should include photographs, P&S, as-built drawings, and surveys. The USACE should be made aware of any modifications of these systems, and copies of these changes should be sent to the USACE offices.

The non-Federal sponsor should coordinate changes with the natural resources agencies to ensure such changes do not result in additional unmitigated impacts or result in possible impacts on threatened or endangered species.

In addition to the non-Federal sponsor inspections, equipment and preventative maintenance databases should also be maintained. By maintaining organized records, local non-Federal sponsors can document inspections and document any changes to the system, thereby ensuring that the overall system maintains its ability to reduce the risk from storm damage to the citizens of the area.

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SECTION 9.0
SUMMARY OF HSDRRS IMPACTS AND CONCLUSIONS



9.0 SUMMARY OF HSDRRS IMPACTS AND CONCLUSIONS

This section provides a summary of impacts from HSDRRS construction (HSDRRS 2011), future levee lifts (HSDRRS 2057), cumulative impacts of all HSDRRS construction (HSDRRS 2011 and HSDRRS 2057), and cumulative impacts of HSDRRS and other regional projects. The intensity of impacts described in the CED is classified as negligible, minor, moderate, or major. The impacts assessed in the CED are limited to those IERs that were completed by November 15, 2010 and from construction activities and borrow site excavation completed by July 2011. Therefore, this version of the CED does not complete the description of the HSDRRS cumulative impacts, mitigation measures, and closure of data gaps. As such, it is anticipated that CEMVN will prepare supplement(s) to the CED to include this additional information.

9.1 SUMMARY OF HSDRRS 2011 CONSTRUCTION IMPACTS

Table 9-1 summarizes the intensity of the permanent adverse impacts of the HSDRRS by sub-basin for those IERs completed by November 15, 2010 and construction implemented by July 2011. Table 9-2 summarizes the intensity of permanent impacts of the HSDRRS borrow actions described by IERs completed by November 15, 2010, and borrow excavation implemented by July 2011 by parish and county, for those borrow sites located outside the HSDRRS project area. Detailed descriptions of all impacts of the HSDRRS, including temporary and permanent adverse impacts, are found in the section 4.0 for each applicable resource subsection. Mitigation measures are described in section 5.0.

Most resources analyzed in the IERs and the CED were impacted during active construction, and most impacts were either temporary or short-term, and limited to the length of the period of construction. In general, most of these resources will return to the pre-construction or near preexisting conditions after cessation of the construction activities. The following is an overview of the HSDRRS 2011 construction impacts.

Soils

Erosion of soils from stormwater runoff at construction and staging areas occurred. There was a permanent loss of biological productivity of soils from the larger footprint of HSDRRS structures, but most of these impacts occurred on previously disturbed soils. There was a permanent loss of 51.6 acres of prime farmland soils from the HSDRRS construction and a loss of up to 5,129.7 acres of prime farmland soils would occur from borrow site excavation. Overall, there was a major adverse impact on soils from HSDRRS construction due to the loss of prime farmland soils. However, soils in the HSDRRS project area would be inundated less frequently and crop destruction from flooding would be less likely. Prime farmland soils would benefit from less frequent inundation due to storms.

Water Quality

Construction impacts included temporary increases in turbidity, water temperature, and sedimentation, potential increases in contaminants from petroleum, oil, and lubricant spills, and decreases in DO within waterways near the HSDRRS project areas. There were several HSDRRS reaches where the base of the earthen levee was expanded or the levee realignment was redirected into open water of a bayou or lake. These actions temporarily impacted water quality through increased sedimentation during construction activities, but impacts on water quality ceased once the levee material stabilized and was armored. Dredging activities and stockpiling of dredged materials caused a temporary increase in suspended sediments in the water column. Hydrology was temporarily impacted due to cofferdam use at temporary canal closures. Hydro-modification at gated structures and floodwalls caused permanent impacts on water quality through changes in water velocity and salinities. The HSDRRS increased the amount of impervious surfaces on formerly undeveloped landscapes.

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Table 9-1. Intensity of the HSDRRS 2011 Permanent Adverse Impacts by Sub-basin¹

Resource	Negligible Impacts									Minor Impacts						Moderate Impacts						Major Impacts																			
	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche	Lake Cataouatche	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche	St. Charles	Jefferson East	Orleans East	New Orleans East	Chalmette Loop	Belle Chasse	Gretna-Algiers	Harvey Westwego	Lake Cataouatche					
Soils										X	X	X				X	X																						X		
Water Quality												X			X		X		X	X	X																				
Wetlands			X															X	X	X	X																				
Uplands	X	X	X			X	X	X	X				X	X																											
Fisheries										X		X	X	X	X	X	X	X	X		X																				
Wildlife		X		X						X		X			X	X	X	X						X																	
EFH	X					X	X	X	X			X		X						X			X																		
T&E Species	X	X	X	X	X	X	X	X	X																																
Cultural	X	X	X	X	X	X	X	X	X																																
Recreational	X				X	X	X				X	X	X					X	X																						
Aesthetics											X		X	X	X			X		X					X			X													
Air Quality	X	X	X	X	X	X	X	X	X																																
Noise	X	X	X	X	X	X	X	X	X																																
Transportation																				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Socioeconomic	X	X	X	X	X	X	X	X	X																																
HTRW	X	X	X	X	X	X	X	X	X																																

Note: Within the CED, Cultural Resources, Socioeconomics and EJ, and Air Quality were presented by parishes within the HSDRRS project area.

¹ For HSDRRS actions described by IERs completed by November 15, 2010, and construction contracts implemented by July 2011.

Table 9-2. Intensity of the HSDRRS 2011 Permanent Adverse Impacts outside the HSDRRS Project Area (Borrow Sites)¹

Resource	Negligible Impacts						Minor Impacts						Moderate Impacts						Major Impacts													
	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany	Hancock	Ascension	East Baton Rouge	Iberville	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. John the Baptist	St. Tammany
Soils																							X	X	X	X	X	X	X	X	X	X
Water Quality	X	X	X	X	X	X	X	X	X	X																						
Wetlands	X	X	X	X	X	X	X	X	X	X																						
Uplands											X		X		X		X		X		X	X	X									
Fisheries	X	X	X	X	X	X	X	X	X	X																						
Wildlife	X	X	X	X		X	X		X	X				X		X						X										
EFH	X	X	X	X	X	X	X	X	X	X																						
T&E Species	X	X	X	X	X	X	X	X	X	X																						
Cultural	X	X	X	X	X	X	X	X	X	X																						
Recreational	X	X	X	X	X	X	X	X	X	X																						
Aesthetics		X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
Air Quality	X	X	X	X	X	X	X	X	X	X																						
Noise	X	X	X	X	X	X	X	X	X	X																						
Transportation											X		X			X	X	X	X	X	X	X	X									
Socioeconomic	X	X	X	X	X	X	X	X	X	X																						
HTRW	X	X	X	X	X	X	X	X	X	X																						

¹ For HSDRRS actions described by IERs completed by November 15, 2010, and construction contracts implemented by July 2011.

This decreased the surface area that can capture and absorb rainfall, which resulted in a larger percentage of rainfall runoff during a storm event. Overall, HSDRRS construction had a minor to moderate permanent impact on water quality.

Wetlands

There was estimated to be a direct loss of 1,502.49 acres (824.02 AAHUs) of wetlands and 3,625.81 acres (1,810.77 AAHUs) of non-jurisdictional BLH as a result of HSDRRS construction and borrow site excavation, which was a moderate adverse impact on wetlands. Approximately 9.6 acres of these wetlands impacts occurred within the Bayou aux Carpes CWA Section 404(c) area. However, compensatory mitigation will offset the loss of wetland functions. Mitigation bank credits are being purchased by contractors and/or landowners concurrently with impacts on non-jurisdictional BLH at contractor-furnished borrow sites. No direct impacts on jurisdictional wetlands occurred at the borrow sites. Temporary impacts on wetlands occurred through minor changes in hydrology from hydro-modification in the project area. Construction indirectly impacted wetlands and non-jurisdictional BLH due to changes in hydrology and inundation levels.

Uplands

The area of permanent impacts on uplands from HSDRRS construction was small (estimated at approximately 49 acres) when compared to the hundreds of thousands of acres of uplands, both developed and undeveloped, in the entire project area. Impacts on uplands occurred primarily on existing levees and in developed areas. Some mature vegetation was lost in upland areas as a result of HSDRRS construction, but the majority of this vegetation was composed of landscape trees and shrubs, turf grass (on levee slopes), and shrub-scrub habitat. Borrow excavation converted uplands to open water, and borrow site excavation was the primary cause of the loss of upland habitat from HSDRRS construction. The conversion of uplands to open water was a permanent minor impact on upland habitat.

Fisheries

The HSDRRS impacts on fisheries and fish habitats included effects on migratory movements, active/passive transport of eggs and larvae, nursery habitat recruitment of larvae and juveniles, changes in water characteristics (e.g., temperature, salinity, turbidity, and DO), organism access to habitats (e.g., protection from predators and food availability), and hydrology and velocity. Loss of estuarine marsh and open water habitats potentially increased habitat fragmentation, altered hydrology, and affected habitat quality, having long-term minor impacts on fisheries. Also, construction impacts on water quality displaced less tolerant aquatic species in some waterways in the short-term. Lake bottom losses due to construction activities in Lake Pontchartrain impacted foraging habitat for finfish and shrimp. In construction areas within waterways, motile aquatic species were likely to avoid the area and find refuge in adjacent suitable habitat, but these aquatic species returned once construction activities were complete. The construction of the cofferdams within waterways such as Bayou Bienvenue and the IHNC temporarily hindered the movement of fish and other aquatic organisms through the area until the cofferdam was removed. Overall, the permanent impacts on fisheries from HSDRRS construction were minor.

An increase in organic material from hydrological improvements associated with levee drainage and crossings would enhance primary productivity (e.g., microbial, plankton, and emergent vegetation) supporting the trophic structure and stamina needed for fisheries to recover and remain sustainable. The installation of rock shoreline, fronting protection, and breakwaters would provide more productive habitat for fisheries by improving edge habitat along shorelines that were previously comprised of the unvegetated toe of a levee or floodwall.

Wildlife

Construction activities had temporary impacts on various types of wildlife due to construction equipment noise and movement and the alteration of foraging habitat within the HSDRRS project area. Small mammals, reptiles, fish, and nesting and wading birds are some of the wildlife that were likely impacted during construction of the HSDRRS projects. Typically, the wildlife displaced by the construction activities could return to the area following construction. In many cases, the disturbed habitat was within the footprint of an existing levee or floodwall, and was of fairly low quality.

Dredging activities in canals and waterways, dredged material stockpiling, and construction of foreshore protection and wave attenuation features (Jefferson East Bank sub-basin) caused temporary indirect and direct impacts on wildlife inhabiting the terrestrial shoreline, primarily ducks and wading birds. Also, the installation of gates, pump stations, and other closure structures caused impacts on open water fish habitat during construction activities. Permanent impacts from HSDRRS construction on wildlife and wildlife habitat were mostly minor.

Essential Fish Habitat

Dredging, filling, levee realignment, and hydro-modification associated with the construction of the HSDRRS had minor permanent impacts on EFH and Federally managed species. Dredging activities suspended sediments in the water column, which caused an increase in turbidity and also affected light levels throughout the water column. Dredging of canals and waterways permanently altered the channels' cross-sectional area and bottom material. Sediment resuspension from dredging activities, for example at Jefferson East Bank, blanketed lake bottom sediments and disturbed benthic organisms such as rangia clams. Surface soils disturbed by construction were transported to adjacent water-bodies during rain events, creating processes and impacts similar to those for dredging activities. Impacts on EFH varied by sub-basin, but overall, permanent adverse impacts on EFH from HSDRRS construction were minor.

In areas where hard fill would be added, increased edge habitat would be created that would be used by Federally managed species for foraging and/or spawning. The hard fill would have beneficial impacts on EFH by providing protection to larval and juvenile fishes, nursery habitat, and by providing additional edge habitat for foraging by larger fish. The hard substrate would also provide habitat for sessile filter feeders. Over time, the filter feeders would enhance the water quality nearshore. Finally, an increase in rocky material would benefit local assemblages of nekton that are important to sustaining Federally managed fisheries, especially blue crab.

Threatened and Endangered Species

Along Lake Pontchartrain and Lake Borgne, minor adverse short-term impacts occurred from temporary disturbances to foraging areas for the West Indian manatee, Gulf sturgeon, Kemp's Ridley sea turtle, loggerhead sea turtle, and green sea turtle. Within the aquatic habitat of the LaBranche wetlands, adverse impacts potentially occurred on foraging areas for the West Indian manatee; however, there was a low probability that manatees were present during construction. No permanent impacts occurred on threatened and endangered species from the HSDRRS construction, and concurrence was received from the USFWS on all HSDRRS actions in accordance with Section 7 of the Endangered Species Act. Further, there has been no take of threatened or endangered species in construction areas.

Cultural Resources

The HSDRRS was subjected to an archaeological survey prior to any ground-disturbing activities. The cultural resources survey areas exceeded the size of the preliminary APE, allowing USACE archaeologists to adjust the APE as needed to avoid any damage to historic properties with potential eligibility for the NRHP. Section 106 consultation with the Louisiana SHPO was completed for all HSDRRS IERs, and impacts on cultural resources were avoided during HSDRRS construction.

Recreational Resources

Construction-related noise and vibration caused localized impacts on the overall recreational experience, including impacts on recreational features associated with biking, walking, jogging, wildlife viewing, boating, and recreational fishing. The Coconut Beach volleyball complex has been closed and will be permanently relocated because of the construction of the permanent pump station. However, overall recreational opportunities were expected to return to pre-construction conditions in most sub-basins. The location and size of flood risk reduction structures, such as floodgates, fronting protection, and pump station outflows, temporarily impacted recreational boat access and resulted in detours. Boat access to the IHNC via Lake Pontchartrain during construction of the Seabrook gate complex was suspended. In general, temporary impacts on recreational boating were most evident during times when several waterways were closed concurrently. Overall, the permanent impacts on recreational resources from HSDRRS construction were negligible to minor.

Aesthetics

Impacts from the numerous construction sites and traffic congestion in the project area temporarily affected the viewsheds until construction was completed. Staged equipment and supplies on bike and walking paths, green space, and levees temporarily impacted access and availability of green space and paths during construction, reducing the ability for visitors to enjoy viewsheds. The vistas along Lake Pontchartrain and other water bodies were adversely impacted, both in the short-term during construction and permanently, due to the potential loss of visual viewshed opportunities. Overall, the permanent impacts on visual resources from the HSDRRS were minor to moderate. However, a reduction in the frequency of flooding and storm surge devastation in the region would allow vistas and viewsheds to remain undamaged and reduce the risk of damage to structures.

Air Quality

Air emissions associated with the HSDRRS were temporary and only lasted during the time period required for completion of construction activities. Based on modeling used to quantify air emissions associated with both construction activities and building material transportation, projected air emissions did not exceed *de minimis* levels for non-attainment parishes or did not conflict with state air quality implementation plans. Based on these evaluations, impacts on air quality of the HSDRRS were less than significant. No permanent adverse impacts on air quality occurred from HSDRRS 2011 construction.

Noise

Noise emissions associated with the HSDRRS were temporary and only lasted during the time period required for completion of construction activities. Approximately 2,814 acres of land within the JLNHPP and 8,051 acres of land within Bayou Sauvage National NWR are within the minimum recommended noise abatement criterion for NPS lands. A number of state and city parks are located near the HSDRRS, including Bayou Segnette State Park, London Park, Ozone Park, Zephyr Park, Woodlake Park, St. Bernard State Park, Lake Shore Park, Pontchartrain Park, Lake Shore Park, Linear Park, and Williams Boulevard Park, and had the potential to experience noise emissions greater than 57 dBA. Approximately 8,037 single-family homes, 268 apartment buildings, 20 churches, 26 schools, including the University of New Orleans, and three hospitals are located near the edge of the project corridors. These sensitive noise receptors experienced noise emissions greater than 65 dBA, which are normally considered unacceptable. Contractors often worked 24 hours a day, 7 days a week. However, no permanent adverse impacts on noise occurred from construction, but operations of new pump stations have the potential for increased long-term noise emissions.

Transportation

Overall, adverse temporary impacts on transportation occurred due to decreased LOS and increased traffic accident risk during the construction period. Increased construction traffic

caused temporary congestion and traffic delays, and potentially increased traffic accidents. Permanent moderate impacts on transportation occurred due to road and bridge degradation from use for material delivery and movement of construction equipment. Construction of the HSDRRS components caused adverse temporary impacts on local waterborne transportation in the Chalmette Loop and Belle Chasse sub-basins. Navigation within Hero Canal was restricted to vessels that passed through the 56 ft wide gate, and waterborne access through the Company Canal and the Harvey Canal had some adverse temporary impacts when construction activities were conducted on a marine plant or temporary work platforms located over water. However, the reduced risk of flooded and submerged roads would cause beneficial impacts on local roadways and highways by maintaining traffic flows during storm events and reducing the frequency of maintenance, repair, or reconstruction.

Socioeconomic Resources and Environmental Justice

Adverse impacts on businesses, industries, and related employment and housing, as well as any disproportionate impacts on minority and low-income communities within the HSDRRS project area were temporary and occurred during construction activities. No permanent socioeconomic impacts occurred. These construction-related impacts occurred due to general traffic congestion, road and highway closures, noise, and closures of navigation channels. Long-term benefits from reduced risk of hurricane and storm damage to structures and infrastructure will be realized for all residents and businesses in the Greater New Orleans Metropolitan Area, regardless of race or income level.

The HSDRRS would induce spending on reconstruction and redevelopment of housing and businesses, and allow FEMA NFIP certification, thereby providing an economic benefit to the community. Continued eligibility in the NFIP for properties in the HSDRRS area would encourage long-term investment in the region and aid in a strong and sustainable recovery of the population in the region. Greater numbers of former residents may return with the knowledge that there is a greater level of risk reduction. The added safety would also ensure long-term beneficial impacts on the businesses and industries within the project area, which would reflect positively on employment and income in the HSDRRS region.

Hazardous, Toxic, and Radioactive Waste

All potential HTRW contamination within the HSDRRS was identified and evaluated prior to the start of construction activities. All identified RECs were avoided, or if avoidance was not possible, the non-Federal sponsor was responsible for remediation. If construction revealed the existence of previously unknown HTRW, then work in that area stopped until the risk from HTRW was evaluated, and the appropriate response was determined. No permanent impacts from HTRW occurred as a result of HSDRRS construction.

The HSDRRS reduces the potential in the future for mixing of floodwaters with sewage, contamination of drinking water supplies, and the potential for mobilization of HTRW. When flooding occurs, these constituents could enter surface waters, causing temporary reductions in surface water quality and potentially causing soil and sediment contamination within the project area. The HSDRRS reduces the risk of flood-related contamination.

Mitigation Measures

The CEMVN committed to certain mitigation measures to minimize adverse impacts on resources. Details on the mitigation efforts employed by the CEMVN during the HSDRRS construction can be found in section 5.0. Some general mitigation measures included:

- Compensatory mitigation for wetlands and non-jurisdictional BLH impacts (see, e.g., most risk reduction and borrow IERs)

- Avoidance methods and the use of buffer zones for the minimization of impacts on various resources including wetlands and cultural resources, and also near environmental justice communities, other socioeconomic resources, and HTRW (see, e.g., IER #31 for HTRW and wetlands impacts, IER #25 for cultural resources)
- Cultural and biological monitoring during construction activities (see, e.g., IER #18 for cultural resources and IER #1 for biological monitoring)
- Use of signage, temporary rerouting of roads during construction, and installation of temporary turn lanes near construction areas to minimize transportation impacts (see, borrow IERs)
- Use of dust suppression methods such as watering of construction sites for the minimization of impacts on various resources (see, e.g., many borrow IERs and per the SWPPPs for the risk reduction IERs)
- Use of noise-reducing mufflers on high-decibel equipment and restriction of construction to specific times and days (see, e.g., IER #5 for pile-driving activities)
- Use of silt curtains at constructions areas and other BMPs (see, e.g., IER #3)
- Containment of fuel and construction-required chemicals for minimization of impacts on various resources including HTRW and air quality (see, e.g., risk reduction IER SWPPPs)

9.2 SUMMARY OF HSDRRS 2057 CONSTRUCTION IMPACTS

The USACE has determined that additional levee lifts of the HSDRRS levees would be required in the future to continue to provide the 100-year level of risk reduction. The need for future levee lifts is based on anticipated future subsidence and sea-level rise within the HSDRRS project area and loading of the foundation that consolidates the soil at the construction sites. For the purpose of this document these levee lifts are identified as HSDRRS 2057 construction requirements. While the HSDRRS 2057 levee lifts were not authorized in the Supplemental Appropriations Acts, they are analyzed below as part of the future cumulative impacts analysis. Future levee lifts would require approximately 7.3 million cubic yards of earthen material. Impacts of the HSDRRS 2057 construction are summarized in table 9-3.

Table 9-3. Intensity of Permanent Adverse Impacts of the HSDRRS 2057 Construction

Resource	Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Soils				X
Water Quality		X		
Wetlands			X	
Uplands		X		
Fisheries		X		
Wildlife Resources		X		
EFH		X		
Threatened and Endangered Species	X			
Cultural Resources	X			
Recreational Resources	X			
Aesthetics		X		
Air Quality	X			

Table 9-3, continued

Resource	Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Noise	X			
Transportation		X		
Socioeconomics and Environmental Justice	X			
HTRW	X			

Soils

Approximately 7.3 million cubic yards of borrow material (i.e., suitable soils) would be required to build the future levee lifts. This is significantly less than the 29 million cubic yards (USACE 2011f) that was projected for the HSDRRS 2011 construction. Additional soils, including prime farmland, would be permanently lost through borrow site excavation, and would be a major permanent impact. The borrow sites from which future material would be removed are not known, and borrow sites approved for HSDRRS construction would not necessarily be utilized for future levee lifts. Soil erosion at construction sites would occur from stormwater runoff.

Water Quality

Short-term impacts on water quality would occur due to sedimentation and turbidity from soil movement during construction. Further, there is the potential for contaminants from petroleum, oil, and lubricant spills, and decreases in DO within waterways near levees subject to additional lifts. Temporary, minor water quality impacts would occur due to increased nutrient loading, SOD, and miscellaneous debris. Construction-related impacts would also affect lake bottoms, canal bottoms, drainage waterways, and open water, and cause permanent minor impacts on water quality. Dredging of Lake Pontchartrain and material stockpiling for access to foreshore protection and wave attenuation features in the New Orleans East sub-basin could increase turbidity, disrupt water bottoms, and destroy SAV.

Wetlands

Some wetland and non-jurisdictional BLH loss is anticipated to occur with future levee lifts and improvements on foreshore protection within the New Orleans East sub-basin. The area of wetland and non-jurisdictional BLH loss is difficult to estimate at this time, but approximately 154 acres of wetlands could be impacted as a result of future levee lifts. However, all lost wetland functions would be fully mitigated. The permanent impacts on wetlands from future levee lifts would be moderate.

Uplands

Impacts on uplands would occur on turf grass on levee slopes and developed areas within the HSDRRS project area. An additional 7.3 million cy of borrow are anticipated to be needed for future levee lifts. That material would likely be removed from existing upland habitats, converting those upland areas to open water, and causing a permanent minor impact on uplands. However, until borrow sites are selected, the locations of these impacts are not known.

Fisheries

No direct impacts on fisheries are anticipated from future levee lifts and HSDRRS structure maintenance. Indirect impacts on fisheries could occur during construction from increased sedimentation and turbidity of water from soil erosion. These indirect impacts would be short-term. Waterway impacts could occur from the dredging and dredged material stockpiling in Lake Pontchartrain. The associated repair or construction of foreshore protection and wave attenuation features (New Orleans East sub-basin) that were described in IERs #6 and #7 but determined to be unnecessary to provide the 100-year risk reduction for the HSDRRS 2011 construction may be raised in elevation before 2057. Permanent impacts on fisheries from HSDRRS 2057 construction would be minor.

Wildlife

Construction activities associated with future levee lifts would have temporary impacts on wildlife due to construction equipment noise and movement. Some wildlife habitat at the toe of existing levees would be permanently lost with increased levee footprints. Wildlife habitat would be permanently lost at borrow sites to accommodate the additional estimated 7.3 million cy of material needed for future levee lifts. These permanent impacts on wildlife and wildlife habitat would be minor. Prior to construction of future HSDRRS projects, coordination with USFWS would occur for reaches located near bald eagle nests or nesting bird colonies.

Essential Fish Habitat

Wetlands located on the flood side of levees enlarged by future levee lifts would be permanently impacted, which could cause a permanent loss of EFH. Short-term construction-related EFH impacts would include damage to SAV, disturbance to sediments, and increased turbidity and sedimentation in and adjacent to EFH. Some additional open water and EFH impacts could occur if dredging activities and dredged material stockpiling in Lake Pontchartrain and the associated repair or construction of foreshore protection and wave attenuation features (New Orleans East sub-basin) are determined to be necessary to provide 100-year risk reduction for HSDRRS 2057. These impacts were previously described in IERs #6 and #7, but were determined to be unnecessary to meet the HSDRRS 2011 100-year level of risk reduction and, therefore, were not previously constructed. No other impacts on EFH are anticipated from future levee lifts.

Threatened and Endangered Species

No permanent impacts would likely occur on any species currently listed as threatened or endangered or their supporting critical habitats due to future levee lifts. However, dredging activities and dredged material stockpiling in Lake Pontchartrain for the repair or construction of foreshore protection and wave attenuation features may be necessary by 2057 to provide the 100-year level of risk reduction. The dredging and stockpiling of material in Lake Pontchartrain for foreshore protection features would temporarily impact foraging areas for the Gulf sturgeon, Kemp's ridley sea turtle, loggerhead sea turtle, and green sea turtle.

Cultural Resources

The potential APE for future levee lifts would be surveyed and all historic resources potentially eligible for the NRHP would be avoided. Section 106 consultation with the Louisiana SHPO would be completed prior to any future ground-disturbing activities. Therefore, no adverse impacts would occur on cultural resources.

Recreational Resources

Future levee lifts would cause short-term impacts on levee-top recreational features associated with biking, walking, jogging, and wildlife viewing. No permanent impacts on recreational resources are anticipated.

Aesthetics

Construction material and equipment associated with future levee lifts would temporarily affect the viewsheds until construction was completed. Dredging in Lake Pontchartrain for foreshore protection and wave attenuation feature access channels would temporarily impact the viewshed from the lakeshore in New Orleans East. Minor permanent impacts on visual resources are anticipated from future levee lifts, additional borrow site excavation, and potential foreshore protection and wave attenuation construction as previously described in IERs #6 and #7.

Air Quality

Air emissions associated with future levee lifts would be temporary and only occur during the time period required for completion of construction activities. No permanent impacts on air

quality are anticipated. However, if the New Orleans Metropolitan Maintenance Area becomes non-compliant, future levee lifts could have adverse impacts on air quality.

Noise

Noise emissions associated with future levee lifts would be temporary and would only occur during the time period required for completion of construction activities. No permanent noise impacts from HSDRRS 2057 construction would occur. However, those noise emissions could impact sensitive receptors during the construction period for levee lifts, and could occur up to 24 hours a day, 7 days a week.

Transportation

Increased construction traffic would cause temporary congestion and traffic delays, and a reduction in LOS would occur at specific road segments near active levee lifts and borrow excavation. Minor permanent impacts on transportation would occur from future levee lifts due to degradation of infrastructure from additional truck traffic.

Socioeconomic Resources and Environmental Justice

No substantial permanent economic impact would occur from future levee lifts. The maintenance of the 100-year level of risk reduction would provide increased safety for businesses, residences, and other economic investments for the life of the HSDRRS.

Hazardous, Toxic, and Radioactive Waste

All potential HTRW contamination within areas where levee lifts would occur would be identified and evaluated prior to the start of construction activities. All identified RECs would be avoided, or if avoidance is not possible, the non-Federal sponsor would be responsible for remediation. If construction reveals the existence of previously unknown HTRW, then work in that area will be stopped until the risk from HTRW is evaluated and the appropriate response is determined. No permanent impacts would occur.

9.3 THE HSDRRS CUMULATIVE IMPACTS

9.3.1 Cumulative Impacts of HSDRRS 2011 and 2057

The HSDRRS construction and future levee lifts needed to maintain the 100-year level of risk reduction for the life of the project would have cumulative impacts on the natural and human environment in the Greater New Orleans Metropolitan Area. Table 9-4 summarizes the intensity of the cumulative impacts from the HSDRRS 2011 and HSDRRS 2057 construction, and an overview of those impacts is provided below.

Table 9-4. Intensity of the Cumulative Adverse Impacts of HSDRRS 2011 and HSDRRS 2057 Construction on Significant Resources

Resource	Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Soils				X
Water Quality			X	
Wetlands			X	
Uplands			X	
Fisheries		X		
Wildlife Resources		X		
EFH		X		
Threatened and Endangered Species	X			
Cultural Resources	X			
Recreational Resources	X			

Table 9-4, continued

Resource	Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Aesthetics		X		
Air Quality	X			
Noise	X			
Transportation			X	
Socioeconomics and Environmental Justice	X			
HTRW	X			

Soils

The cumulative impacts on soils would be from the permanent loss of soils, including prime farmland soils, at borrow sites. As much as 5,181.3 acres of prime farmland soils could be lost from HSDRRS construction and borrow site excavation, which would be a major cumulative impact. Cumulative long-term beneficial impacts on soils would result from the HSDRRS due to a lower risk of inundation from storm events.

Water Quality

Cumulative impacts on water quality would occur from filling of waterways and wetlands for HSDRRS construction and future levee lifts. Sedimentation and nutrient loading of waterways from stormwater runoff during rain events has occurred from the cumulative construction activities, dredging, filling, material stockpiling, water body displacement, and hydrologic modifications. The permanent cumulative impacts on water quality from all HSDRRS construction activities would be moderate.

Wetlands

Over 5,000 acres of wetlands and non-jurisdictional BLH would be cumulatively impacted as a result of HSDRRS construction. Although wetlands and non-jurisdictional BLH would be directly impacted through dredging and filling activities, all lost functions of wetlands and non-jurisdictional BLH would be fully mitigated, and direct impacts on wetlands at borrow sites would be avoided entirely. Therefore, the cumulative impacts on wetlands from all HSDRRS construction would be moderate.

Uplands

Cumulative impacts on uplands would primarily occur at borrow sites, where borrow site excavation has converted and will continue to convert uplands to open water areas. The loss of upland habitat at borrow sites would cumulatively be a moderate impact.

Fisheries

Filling of waterways and wetlands for HSDRRS construction and future levee lifts cumulatively impacts fisheries and fish habitat. Temporary closures of waterways during construction activities cumulatively impact fish by reducing movement locally. Minor changes in salinities and flow velocities as a result of gated structures have cumulative long-term minor impacts on estuarine-dependent fish movement and use in Lake Pontchartrain.

Wildlife

Less mobile wildlife species within the ROW for construction were likely killed during construction activities, and habitat for wildlife was lost when wetlands, waterways, and uplands were converted to risk reduction structures. This scenario would likely repeat for HSDRRS 2057 construction. However, most of the wildlife and habitat lost are locally and regionally common and are associated with urban or developed areas; therefore, the cumulative impacts on wildlife would be minor. The continued use of borrow sites for future levee lifts would cumulatively contribute to the loss of wildlife habitat.

Essential Fish Habitat

The dredge, fill, and material stockpiling activities, filling of waterways and wetlands, hydrologic modification of waterways, and construction activities in waterways would have cumulative minor permanent impacts on EFH. Future levee lifts would contribute to the cumulative loss of EFH through filling of intertidal wetlands.

Threatened and Endangered Species

No long-term cumulative impacts would occur on any currently listed threatened or endangered species from HSDRRS construction and future levee lifts. Cumulative impacts on Gulf sturgeon foraging habitat from dredging of access channels would occur from future foreshore protection and wave attenuation features in the New Orleans East sub-basin. These impacts would be minimized by implementing mitigation measures for dredging activities in Gulf sturgeon critical habitat, as recommended by NMFS.

Cultural Resources

All historic resources potentially eligible for the NRHP were avoided during HSDRRS construction and would be avoided during future levee lifts. Completion of Section 106 consultation with the Louisiana SHPO prior to all ground-disturbing activities for the HSDRRS would ensure that no adverse cumulative impacts would occur on cultural resources potentially eligible for the NRHP.

Recreational Resources

Temporary cumulative impacts on recreational resources occurred during construction activities, and temporary impacts associated with access closures would occur during the life of the HSDRRS due to future levee lifts. The construction of the HSDRRS and future levee lifts provide a cumulative benefit on recreational resources by reducing the risk of hurricane and storm damage to recreation facilities, paths, parks, infrastructure, and green space. Most recreational resources in the HSDRRS project area returned to near pre-construction conditions after HSDRRS construction was completed, and the cumulative impacts of past and future HSDRRS construction would be negligible.

Aesthetics

Cumulative impacts on visual resources occurred during construction activities and are temporally and spatially limited to active construction sites. However, impacts on aesthetics would occur for the life of the project, as construction activities would periodically occur through 2057. The cumulative impacts of HSDRRS construction on visual resources are minor.

Air Quality

There would be no permanent cumulative impacts on air quality. All air emissions are temporary and are associated with specific construction projects, including future levee lifts, and the air quality would return to background levels after construction.

Noise

Cumulative temporary noise impacts would occur on sensitive receptors during HSDRRS construction activities and future levee lifts. However, impacts would be short-term at any construction location and would return to ambient conditions following construction.

Transportation

Cumulative moderate adverse transportation impacts, such as damage and degradation of infrastructure and wear-and-tear on roadways due to increased truck traffic, occurred throughout the project area. Increased traffic congestion and reduced LOS would likely occur in the vicinity of future construction. Lower flood risk from hurricanes to the roadways in the Greater New Orleans Metropolitan Area would be a cumulative beneficial impact on transportation.

Socioeconomic Resources and Environmental Justice

All citizens within the project area, regardless of race, income level, or age, experience short-term impacts associated with heightened noise levels, increased traffic, damaged roads, and air emissions from HSDRRS construction. Additionally, all citizens in the HSDRRS project area benefit equally from a lower risk of flooding from hurricanes. No permanent cumulative adverse impacts occurred on socioeconomic resources. Cumulatively, expenditures in the region for construction, maintenance, and future levee lifts have provided billions of dollars to the economy of the region, which is a beneficial impact. No cumulative permanent disproportionate impacts on minority or low-income communities are anticipated.

Hazardous, Toxic, and Radioactive Waste

All potential HTRW contamination was identified prior to construction activities, and avoided or remediated, as necessary; therefore, no cumulative impacts from HTRW contamination occurred.

Similar procedures would be followed for future construction. Accordingly, no adverse HTRW impacts would be anticipated. Beneficial impacts in the form of reduced risk of HTRW contamination during flooding events are also likely.

9.3.2 Cumulative Impacts of Past, Present, and Future Regional Actions

Cumulative impacts were described in detail in section 4.0, and as anticipated, the HSDRRS has contributed and will continue to contribute to cumulative impacts in the Greater New Orleans Metropolitan area and in southeast Louisiana. Table 9-5 provides a summary of the intensity of cumulative impacts of HSDRRS and other present and future regional actions.

Table 9-5. Intensity of the Cumulative Adverse Impacts of HSDRRS and Other Past, Present and Future Regional Actions on Significant Resources

Resource	Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Soils				X
Water Quality			X	
Wetlands				X
Uplands			X	
Fisheries		X		
Wildlife Resources			X	
EFH			X	
Threatened and Endangered Species	X			
Cultural Resources		X		
Recreational Resources	X			
Aesthetics	X			
Air Quality	X			
Noise	X			
Transportation			X	
Socioeconomics and Environmental Justice	X			
HTRW	X			

Other ongoing and proposed projects in southeast Louisiana may provide cumulative benefits. For example, projects such as freshwater reintroduction from the Bonnet Carré spillway, CFDC, other CWPPRA diversion projects, and other coastal and wetland restoration projects, including HSDRRS wetlands mitigation activities, would provide long-term benefits to wildlife, fisheries, and sustainability of wetlands regionally. The following provides an overview of the cumulative impacts of HSDRRS and other present and future regional actions.

Soils

Cumulatively, past, ongoing, and future projects in the region would result in the permanent loss of biological productivity of soils as undeveloped areas are developed. All construction projects have the potential for cumulative indirect impacts on soils through erosion and stormwater runoff during construction, and in the long term as the area of impermeable surfaces increases. Major permanent cumulative impacts on prime farmland soils in the region are anticipated as borrow sites are utilized for flood risk reduction projects in the region, and induced development converts agricultural lands to residential and commercial development. These adverse impacts have been determined to be greater than the cumulative beneficial effects on soils that would result from the reduced risk of flooding in areas behind new flood and storm risk reduction features.

Water Quality

In general, construction impacts from all regional projects were determined to temporarily increase turbidity, BOD, water temperature, and sedimentation, and lead to potential increases in contaminants from petroleum, oil, and lubricant spills and decreases in DO within waterways. Regional construction and redevelopment projects would have cumulative short-term adverse impacts on water quality in the region due to stormwater runoff from construction sites, dredging, and hydro-modification. In general, there would be cumulative moderate impacts on water quality in the region.

The construction of both flood damage risk reduction and environmentally beneficial projects, such as coastal restoration projects, would permanently impact the local hydrology in those specific project areas. For example, the closure of the MRGO has altered water flows and salinities regionally and caused episodic low DO events that are expected to be permanent. Water quality in the region currently is impaired because of existing commercial and industrial uses, as well as point source discharges of stormwater and wastewater from industrial sources and pump stations.

River diversion projects (through reduced salinities), in combination with reduced discharges from flooded urban areas, would likely improve water quality in the region. An increase in organic material from hydrological improvements associated with levee drainage and crossings would enhance primary productivity (e.g., microbial, plankton, and emergent vegetation) while supporting the trophic structure and stamina needed for fisheries recovery and sustainability.

Wetlands

The cumulative impact on wetlands from past, ongoing, and future projects in the region, in combination with the high rates of wetland loss in coastal Louisiana, is major, and only through mitigation measures can these impacts be reduced. Coastal and wetlands restoration and creation projects have provided some measures for combating the regional loss of wetlands, but the size of these projects has been small relative to the scale of projects that have contributed to wetland loss. Future large-scale restoration projects proposed by the state and Federal governments would cumulatively provide a major benefit to wetlands in the region but are not likely to fully offset the cumulative adverse impacts of historic flood risk reduction projects on wetland loss.

Indirect cumulative impacts include alterations to habitats and hydrology, which could result in changes to salinity and nutrient loads in local wetlands, leading to additional wetlands loss. Flood risk reduction projects and other regional projects occurring near wetlands would cause damage to adjacent wetlands vegetation (including SAV) and increase turbidity and sedimentation in the adjacent wetlands habitat and drainage canals.

Wetlands and non-jurisdictional BLH would continue to recover in the area due to various coastal and wetland restoration project techniques being employed in southeast Louisiana. Introduction of fresh, nutrient-rich, and sediment-laden water from the Mississippi River, proper

operation of the gates on the IHNC and GIWW, and closure of the MRGO would be potentially beneficial to area wetlands by offsetting existing salinity stress and damage. Likewise, diversion projects such as Violet Freshwater Diversion would be beneficial to area wetlands. The HSDRRS and other regional flood risk reduction projects would fully compensate for their impacts on wetlands functions.

Uplands

Even though minimal in size when compared to the regional extent of forested and grassland habitats directly and indirectly affected by previous development activities, the excavation and use of borrow material in the project area, in combination with other past, present, and future large-scale construction projects, would cumulatively lead to the loss of upland habitats within southeast Louisiana. Based on historical human activities and land use trends in the area, it is reasonable to anticipate that future activities would further contribute to cumulative degradation of the land resources and, ultimately, upland habitats. In southeast Louisiana, most development occurs in the upland areas, which comprise a relatively small portion of the surface area of the region. Most of southeast Louisiana is composed of wetlands, open water, and estuarine habitats and undeveloped and undisturbed upland areas are relatively rare. Therefore, the cumulative loss of upland area that functions as habitat for wildlife and provides forested resources is a long-term, moderate cumulative impact.

Fisheries

Direct cumulative adverse impacts on fisheries and fish habitat are associated with the actual construction activities, the associated dredge, fill, and material stockpiling activities, water body displacement, and hydrologic modifications of waterways and ecosystems. Indirect cumulative adverse impacts on fisheries and their habitats occur from alterations to fish migratory movements, active/passive transport of fish eggs and larvae, nursery habitat, recruitment of fish larvae and juveniles, water characteristics and organism access to abiotic water quality habitats (e.g., temperature, salinity, turbidity, and DO), organism access to biotic water quality habitats (e.g., protection from predators and food availability), and hydrology and water velocity.

Storm damage reconstruction and transportation projects within the HSDRRS project area are anticipated to result in insignificant cumulative impacts on fisheries or fish habitat, since most of the projects proposed are either limited to upland construction or occur in previously disturbed areas. Flood risk reduction projects often alter existing nearshore habitats and impact interior marshes by impacting the natural processes of hydrology, erosion, subsidence, and saltwater intrusion. Water flow and important fish habitats between the protected side and the flood side of levees often become further fragmented.

Flood risk reduction projects, combined with other regional coastal and marsh restoration projects, would result in fish habitat with greater heterogeneity and interspersed and lower salinity levels. Flood risk reduction projects would also provide beneficial impacts on fish habitat through the reduction of storm surge inundation via increased hurricane protection. Future regional projects also provide opportunities for dredged material from the access channels to be used for marsh rebuilding and, thus, fish habitat creation or nourishment.

The cumulative direct and indirect impacts from regional projects that result in the temporary degradation of water quality or the permanent loss of wetlands that serve as quality fish habitat, combined with the current trend of water quality and habitat degradation in southeastern Louisiana, would result in cumulative minor impacts on fisheries and fish habitat regionally.

As water quality and structural habitat improve as a result of habitat restoration and a reduction in discharge of urban flood waters from better operational procedures, fisheries production would increase. Restoration of wetlands would also lead to improved nursery habitat for important finfish. In addition, the rock utilized for shoreline protection and stabilization along

the HSDRRS would, over time, cumulatively benefit fisheries by providing protection for juvenile and larval species and enhancing foraging potential of aquatic prey species. Providing rocky shoreline habitat to otherwise sand and mud benthic communities would expand the surface area for motile and sessile aquatic organisms to inhabit and thrive.

Wildlife

Overall, construction activities associated with the HSDRRS and other proposed regional projects would contribute to the cumulative loss of wildlife habitat and resources within the project area. BLH forests, cypress swamps, marshes, and tidal channels impacted by regional projects provide habitat for an abundance of birds, amphibians, reptiles, and shellfish. Coastal wetlands, marshes, and forests provide permanent habitat or indirectly serve as breeding and rearing refugia for wildlife. Cumulative impacts from construction activity and conversion of natural habitats to developed areas would be moderate and cause habitat fragmentation, altered hydrology, and degraded habitat quality.

Essential Fish Habitat

Regional projects would contribute to cumulative loss of EFH in the project area. Regional projects would adversely impact EFH by causing direct habitat loss through the filling of waterways and marshes and the dredging of water bottoms.

Indirect cumulative impacts include alterations of habitats and hydrology, which could result in changes in salinity and nutrient loads, leading to further degradation of EFH. Past, present, and future flood risk reduction projects and other regional projects occurring near EFH would cause damage to EFH (including SAV) and adjacent wetlands vegetation, disturb fisheries and sediments, and increase turbidity and sedimentation in the adjacent aquatic habitat and drainage canals.

Risk reduction projects directly alter existing shoreline habitat and hydrologically impact marshes by affecting the natural processes of erosion, subsidence, and saltwater intrusion. The historic construction of flood risk reduction projects in southeast Louisiana is responsible for limiting water flow between the protected side of the levee and the flood side of the levee, altering freshwater and sediment input into estuaries and contributing to wetland fragmentation and loss. Future flood and storm risk reduction projects cumulatively add to these impacts on EFH. Large-scale coastal and wetlands restoration projects are anticipated to restore these habitats in the future, and will offset some of these historic losses of EFH. However, the cumulative impacts of regional construction activities on EFH are moderate.

Modification of local drainage systems through freshwater reintroduction from the Bonnet Carré spillway would likely improve water quality in the region, and thereby increase productivity of fisheries as wetlands recover. An increase in organic material from hydrological improvements associated with levee drainage and crossings would enhance primary productivity (e.g., microbial, plankton, and emergent vegetation) and support the trophic structure and stamina needed for fisheries recovery and sustainability.

Threatened & Endangered Species

Regional construction activities would contribute to adverse modification of Gulf sturgeon critical habitat that occurs in the Lake Pontchartrain and Lake Borgne area. These modifications would create permanent adverse impacts on Gulf Sturgeon habitat regionally; however, through Endangered Species Act protection of the Gulf Sturgeon and designated critical habitat, and subsequent consultations with NMFS for adverse effects, these impacts would be minimized. However, the cumulative impacts of regional construction activities on other threatened and endangered species would be negligible, since most construction activities in southeast Louisiana occur in habitats not utilized by listed species.

Other projects proposed in southeastern Louisiana would potentially lessen impacts from implementation of the HSDRRS, including projects such as freshwater reintroduction from the Bonnet Carré spillway, CFDC, and other CWPPRA diversion projects, as well as other coastal and wetlands restoration projects. Projects such as these would provide cumulative long-term beneficial impacts on threatened and endangered species. Some of these projects in southeastern Louisiana would include restoration projects, such as the Bayou Bienvenue Restoration, which would create numerous acres of marsh and swamp through the placement of dredged sediments from the Mississippi River. Other proposed projects, such as shoreline protection projects, would positively impact Lake Pontchartrain and Breton Sound, resulting in lower salinity marshes with greater heterogeneity and interspersion. Enhancement of habitat through wetlands and coastal restoration projects would provide long-term benefits to the area and would be beneficial to threatened and endangered species.

Cultural Resources

While many cultural resource surveys have been conducted within the project APE, future and concurrent regional projects still have the potential to adversely affect cultural resources by the destruction of all or part of eligible archaeological sites, modification of historic structures, or alteration of the viewshed of historic districts. However, for Federal and state projects, if any unrecorded cultural resources that are potentially eligible for listing on the NRHP are located within a project's boundaries, then no work would proceed in the area containing these cultural resources until the SHPO has been notified. However, other current and future regional projects completed by private entities could potentially have direct and indirect cumulative adverse impacts on cultural resources. Therefore, the cumulative regional construction impacts would be minor.

Recreational Resources

Recreational resources would experience temporary cumulative adverse impacts due to the HSDRRS and other ongoing and future regional projects during construction activities. Where construction projects cross recreational areas, temporary closures of access can occur. Some green space and other recreational areas may be permanently lost or impacted, but cumulatively, improvements offered through these regional projects would provide beneficial effects on recreational resources in the HSDRRS area. Cumulative adverse impacts on recreational resources in southeast Louisiana would be negligible.

Aesthetics

Cumulative long-term impacts on visual resources are still evident from Hurricanes Katrina and Rita in the area, and include degraded, damaged, or destroyed homes, facilities, and recreational parks in the area. In general, all regional projects would have short-term moderate construction impacts on visual resources. Most storm damage and redevelopment projects in the region would have beneficial cumulative impacts on visual quality after the construction phase. Flood risk reduction and coastal restoration projects would beneficially impact aesthetic resources and the overall visual viewsheds within the project area, as the risk for storm damage and flooding would be reduced and marshes are created or restored. New and restored infrastructure redevelopment projects would also benefit the aesthetic resources in the project area by upgrading aging or failing infrastructure, which often contributes to a blighted visual quality within an area.

HSDRRS construction and the use of borrow sites have contributed to the permanent cumulative impacts on visual resources. Aesthetically enhanced floodwalls have been used in some locations, which minimize the adverse degradation of the visual quality of HSDRRS structures, reducing the cumulative impacts on aesthetics.

Air Quality

Air emissions were determined to have negligible or no cumulative permanent adverse impacts within the region. For all regional projects, air emissions would be temporary and would only last during the time period required for completion of construction activities. No long-term adverse impacts on air quality would occur from regional construction projects.

Noise

Noise emissions were determined to have negligible cumulative permanent adverse impacts within the region. For all project types, noise impacts would only occur during construction activities and would cause localized and, in some cases, major temporary impacts. While flood risk reduction, infrastructure, and transportation projects would likely expose local residents to elevated noise levels during relatively short construction periods, the variety and distribution of projects across the region make it unlikely that these projects would contribute to adverse cumulative noise emissions.

Transportation

Regional construction projects would contribute directly and indirectly to cumulative impacts on transportation in the project area through increased traffic, damage and degradation of infrastructure, and roadway wear and tear due to increased truck traffic. The lower flood risk to the Greater New Orleans Metropolitan Area upon completion of the HSDRRS could cause additional economic and population growth in the region, and thus, could increase the demand for transportation resources, which could lead to cumulative indirect long-term moderate impacts. However, there would also be long-term beneficial impacts on transportation resources from the HSDRRS construction due to the potential to save millions of dollars in repair costs for transportation infrastructure that could otherwise be damaged by flooding.

Socioeconomics and Environmental Justice

Most adverse impacts on businesses and industries and related employment, housing, and any disproportionate impacts on minority and low-income communities within the HSDRRS project area were temporary during construction activities. These construction-related impacts occurred due to general traffic congestion, road and highway closures, noise, and closures of navigation channels. Temporary direct adverse impacts on low-income and minority populations were minor within the HSDRRS; however, indirect impacts from temporary construction-related activities contributed to an increase in noise and air emissions and nearby traffic congestion during project construction. Additional value would accrue for various purposes, ranging from industrial, commercial, residential, institutional, and public, immediately adjacent to the developments throughout the HSDRRS region. The HSDRRS projects would also contribute to and benefit community and regional growth and recovery (e.g., reduced risk of property flooding).

Hazardous, Toxic, and Radioactive Waste

Cumulatively, all construction projects have the risk of exposing unknown contaminated materials or spilling of potential contaminants during activities such as refueling. All Federal and state projects evaluate the potential for HTRW risks at construction sites prior to the start of construction, minimizing the likelihood for encountering contaminated areas. Construction BMPs are employed to minimize the risk of spills, and to be proactive in the event of an accidental spill. Further, the construction of the HSDRRS and other flood damage risk reduction projects would reduce the risk of additional catastrophic flood events regionally and the related risk of release of HTRW. HTRW was determined to have negligible cumulative permanent adverse impacts within the region.

9.5 CONCLUSION

The devastation to the Greater New Orleans Metropolitan Area and the Gulf Coast from Hurricanes Katrina and Rita created one of the most expensive natural disasters in U.S. history. However, the HSDRRS is the USACE's largest civil works project; it will provide the level of risk reduction necessary to provide public confidence to residents of southeast Louisiana. The CED has described the HSDRRS construction impacts and cumulative impacts. The CED incorporates information from NEPA Alternative Arrangement documents completed by November 15, 2010, and from construction activities implemented by July 2011. As HSDRRS construction has been ongoing and is anticipated to continue until August 2014, and with potential future levee lifts through 2057, the impact assessment, including a description of cumulative impacts and implementation of mitigation measures, is not complete. CEMVN will provide supplement(s) to the CED to augment the information provided in this report, including providing additional information recognized as current data gaps.

The CEMVN has engaged the public throughout the HSDRRS planning process, including 200 public meetings, scoping meetings, and workshops, and over 6,500 field trips to view various features of the HSDRRS during planning and construction. The CEMVN created a website, www.nolaenvironmental.com, in order to make all information generated during the HSDRRS planning readily available to the public. This includes providing the opportunity to review and comment on every IER and IER Supplemental prepared in support of the HSDRRS. The CEMVN will continue with this public outreach through the rest of the HSDRRS planning and construction effort.

The construction of the HSDRRS has, and will continue to have, short-term impacts on both the human and natural environment in the project area. On a local scale or for individuals near construction sites, many of the short-term and localized impacts, such as noise emissions, impacts on recreation resources and aesthetics, and air emissions (e.g., fugitive dust), are significant. However, on a regional basis these impacts are short-term, only occurring during the length of the construction period, and negligible or minor in intensity.

For some resources, where the construction activities altered the physical condition of relatively undisturbed areas, the impacts from the construction of the HSDRRS were of greater intensity and were permanent. To reduce these impacts, mitigation measures have been implemented where possible and where required through legislation such as the Clean Water Act. Further, the HSDRRS was mostly constructed within a highly urbanized environment and did not directly have impacts on these resources beyond the physical boundaries of the constructed features and the excavated borrow sites. Compared to other regional and historic flood control projects and navigation projects that preceded HSDRRS, and modified and confined the Mississippi River and its tributaries, affecting its ability to flood coastal marshes and estuaries with sediment-rich freshwater, the HSDRRS impacts on wetlands, water quality, and fisheries are relatively minor.

Adverse impacts on southeast Louisiana from the 2005 hurricane season were great, and discussion of economic losses and social disruption cannot fully explain the change in the community. It is clear that southeast Louisiana suffered terrible losses and has a long road ahead to fully recover from the devastation experienced in 2005. However, since the start of the HSDRRS, the CEMVN engaged the public through hundreds of meetings for input regarding the design the new 100-year level of risk reduction project components. To the extent practicable, CEMVN minimized impacts on residents, businesses, transportation, and sensitive biological resources during design and implementation of the HSDRRS. CEMVN regularly provided the public with updates on construction progress. The CEMVN has described the HSDRRS project actions in the various IERs and in the CED and has evaluated impacts on the natural and human environment. Through the planning, design, and construction phase of the HSDRRS, the CEMVN continued to develop mitigation processes to compensate for short-term and permanent

impacts on the human and natural environment, such as systematic avoidance of wetlands at borrow sites, requiring mitigation credit purchase for non-jurisdictional BLH impacts at contractor-furnished borrow sites, and implementing a Mitigation Program to address HSDRRS wetland and dry BLH compensatory mitigation needs. Further, because more borrow sites were evaluated in the IERs than were actually utilized for the excavation of borrow material, impacts on soils (including prime farm land soils), non-jurisdictional BLH, and transportation were less than originally described. For other resources, such as air quality and noise, the longer period of construction (through August 2014) than originally anticipated has increased the duration of these impacts beyond those described in the IERs; however, given their temporary nature, those impacts were still determined to be minor or negligible. Throughout this process, the CEMVN has sought to provide the level of risk reduction desired by the community while minimizing permanent losses of important resources that are valued in the region and throughout the U.S.

SECTION 10.0
LITERATURE CITED



10.0 LITERATURE CITED

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SECTION 11.0
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11.0 PREPARERS

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